Electrical World

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A Significant Conference

AN important conference has just been concluded in New York. For two weeks committees of the industry have been in session with representatives of the federal Bureau of Standards reviewing the proposed national electrical safety code promulgated by the latter body. In personnel, in range of activity, in distribution of membership, and in devotion to duty, the committees left nothing to be desired. Every branch of the industry and every section of the country were represented. Engineers and executives of high order labored long and well with singleness of purpose, and the two weeks brought forth a wealth of suggestion and constructive criticism highly important because born of experience. The contribution of the industry to the development of a national code, in time, in money and in experience, has been exceptionally generous. Its counsel has been sought and its advice freely given. It ought to be as freely heeded.

Teaching the Public

FACTS presented so that the man in the street will understand them will help develop the public's innate sense of fair play. Central stations in several cases are calling in printer's ink to help make the public understand what the public corporation as a going business both can and cannot be expected to do. Misunderstanding often arises from misinformation. Statements of gross earnings or even net profits, for example, are ordinarily displayed in the headlines of the public prints unaccompanied by the relative elements of cost and expense. We in America are accustomed to big totals, but the average mind does not arrive at "net conceptions." The every-day consumer sees a six-figure total of gross earnings but does not see huge cost and expense totals, which are the part the management of the corporation has paid back to the public for labor and materials and for interest. A well-made analysis of the earnings and expenses of the average utility corporation would show the facts to the public and help to bring about that good will which is so fundamental an asset of the public utility. A policy of downright frankness touches the very people whose influence is too often thrown, generally without malice, against the industry—those who do not realize, because they do not understand, the peculiar conditions which a central station has to meet, the relation of its gross output to possible prices, the adjustment of its schedules to reach the needs of all classes of consumers, and the various devices by which it has to take account of the difference in the requirements of these consumers in their bearing upon the cost of production. Very few outside of the electrical business realize the actual investment which necessarily stands against, for example, a consumer with a large motor for occasional use very likely to over-run the peak, especially when he is at a considerable distance from the nearest substantial feeder. Consequently a central station may get abused roundly for declining to take on a service from which it can at best extract only a small and uncertain profit. Again, unable to make directly favorable prices for a consumer whose requirements demand small overhead charges and who promises a large amount of business, the central station has to adjust in some way its schedules to make a fair average so as to meet the situation without injustice to anyone concerned. The more educational work which is done in making the public see the intrinsic difficulties of a very complicated business, the less likelihood there is of unreasonable complaints and captious protests to the commissions. It is for this reason that it is wise to lay the cards squarely upon the table and to try to educate the public into a spirit of genuine co-operation. The central stations are in business to make reasonable profits for their shareholders and to give these shareholders a permanent and safe investment. Only on these conditions can they obtain their capital at a figure which will enable them to keep down their overhead charges and to share the economy with the consumer in the form of lower rates. The fact is worth emphasizing that in two decades of steadily rising prices electric service is about the only thing the cost of which to the user has been consistently reduced.

A Question That Needs an Answer

SPEAKING before the American Association of Railway Commissioners at San Francisco, Samuel Insull summed up his address with this significant question: "While I am a strong believer that a monopoly so closely connected with the every-day life of the community as electricity should be regulated by governmental authority, sometimes I wonder whether this regulation may not check enterprise and destroy individuality in management. I sometimes ask myself whether we are not in danger of drifting to a species of paternalism which will end in our simply fulfilling our allotted task and being satisfied with just what we have to-day, forgetful of the fact that the electricity supply is relatively a new industry, that its development and growth and usefulness to the public must depend upon originality of thought and method of inventors, engineers and managers. Heretofore individuality and originality have received the sympathetic support of the owners and

bankers of our properties. But now a new element has come in, and I sometimes ask myself the question, Is that element going to be a help or a bar to future progress?"

Mr. Insull has pointed to a fundamental condition in the electrical industry to-day. Both representatives of the industry and representatives of the public, the commissions, must think in broad economic terms to answer the question for the public good.

The Engineer's Opportunity

TO-DAY is a propitious time for the electrical engineer. He is in a position not only to take advantage of the personal attributes he may bring to his profession but to take advantage also of the trend of the times. World problems on every hand are being considered from a detached, analytical viewpoint which may be termed the engineering method of approach. Systematized knowledge is taking the place of guesswork. Leadership is still personal, but everywhere men are sought who know how. The engineer's contribution is particularly needed in the sister arts and industries which touch the electrical business. As the circle of electrical application circumscribes more and more fields, the opportunities for professional service grow proportionally. An engineer by training and temperament sometimes sees the radius of his activities shortened by the adjective with which he has prefixed his broad training. If he is a mechanical engineer, he goes into the metal-working industries when the woodworking may need him most. If he specializes in electricity during the last two years of his college course, he feels bound to be a designing or operating engineer within the electrical circle. His opportunity and his contribution to society need not be limited to these fields and if, with a lengthened radius, his circle of electrical activity cuts the circle of a contiguous industry, there will often be mutual advantage in the new contact.

Alternating-Current Nomenclature

IT will be remembered by many of our readers interested in single-phase alternating-current motors that a paper was presented by Mr. Val. A. Fynn before the Deer Park A. I. E. E. convention last June on a proposed classification and nomenclature for such motors. This matter is of importance to the A. I. E. E. committee on standards, because the classification of alternating-current motors is at present in a confused and unsettled state. We invited discussion on the subject in our columns, with a view to eliciting opinions, and our issues of Aug. 14 and Oct. 30 contain valuable contributions.

There is still much to be said on the matter, and we hope for further contributions from those who are in a position to form judgments on this particular branch of electric-motor development. Certain preliminary deductions seem to be warranted, however, at the present stage of the discussion.

In the first place, it is evident that steps should be taken to clear up the existing indefiniteness of alternating-current motor terminology. It may not be possible to carry the classification very far, but the present situation is alike deplorable and discreditable to the industry, from the engineering point of view.

Secondly, it seems very doubtful whether a list of terms so lengthy and cumbersome as that proposed by Mr. Fynn, for his forty-seven varieties of single-phase motor, can be practically adopted. Even if they were solemnly accepted, they would probably be used by only a very favored few. The art and the industry insist on short, simple terms. The copper-beech tree appears in some botanical classifications as "fagus sylvatica cum foliis atrorubentibus," and no doubt this full official title makes him a happy man who can properly pronounce it; nevertheless the practical woodsman will continue to call this tree a "beech." Motors are like forest trees in that the more numerous they become the simpler must be their nomenclature in commerce and industry.

Thirdly, it seems desirable to limit immediate attempts at classification to a few well-recognized types. If the classification is well made, the various other cousins, congeners and varieties will find room as subtypes. If, however, too much is attempted at once, the chance of general adoption will be lessened.

Fourthly, it seems desirable to focus attention upon the term "repulsion motor," with a view to deciding whether it is desirable to retain it. It is already so well established that it will be difficult to displace it. But if it is to be retained, it should be defined and delimited; because as some persons use the term it might be held to include motor types so different as the single-phase induction motor or even the ordinary direct-current shunt motor.

If a consensus of opinion can be reached as to the term "repulsion motor" and what should be done with it, then progress might well be hoped for; but as the term stands to-day it is often so loosely employed that many wish the word had never been invented.

Engineering Requirements of City Substations

ARRANGEMENTS of station apparatus have been so carefully worked out in existing installations that certain standard conceptions are usually thought of as representative of best installation and operating economy. Elsewhere in this issue, however, it is interesting to note that a reversal of usual practice in installing rotary converters and switching equipment in a city substation has developed a possible saving of about $4 per kilowatt of equipment for a station rated at 28,000 kw. This saving has been largely brought about by savings in copper and elimination of ducts and runways in the walls of the structure. The transformers are installed under the rotary collector rings so that the low-tension leads are passed directly from the machines to switches beneath. The busbars, feeders and

selector switches are just above the horizontal ducts leading to the underground distribution system. As a result the entire layout has resulted in a compactness worthy of study and further application. The island foundation for the machines and the ventilation of the building and apparatus through supply ducts taking air from the roof are other features. Air is forced as required through the different pieces of apparatus according to load conditions, thereby making it possible to secure a unit operating efficiency proportional to the rating of the equipment. The storage-battery equipment is capable of carrying more than one-third of the maximum station load for a period of one hour, but in addition there are arrangements for feeding the rotaries from many sources, so that the installation is in keeping with the determination of a public-service company to live up to the letter of uninterrupted service.

Familiarity with the Local System

IN central-station work as in any other business team play counts for more to-day than ever before, and it is good for the power-plant staff and the engineers of the distribution system to have an occasional visit from the commercial department representative, and vice versa. Strange to say, the power station offers a field for the use of certain appliances which is too often entirely overlooked. In the offices of the chief engineer of a large station the volume of work done is often sufficient to justify the use of motor-driven adding machines, electric fans in odd corners, electric cigar lighters, and perhaps an immersion heater or a luminous radiator, the last being particularly useful in hydro-electric installations. The company might do worse than to install a coffee percolator for the night shift in particular, and a small disk stove or two could be used to advantage in a good many stations where the midnight meal is the only break in the vigil to maintain good service between dusk and dawn. The installation of electrical conveniences would be impressive from the advertising standpoint when visitors go through the plant, and most installations have a good many of these in the course of a year. Energetic managers are encouraging employees of all departments, sometimes with commissions, to do their share in the placing of appliances in the homes and shops of their friends, and those in the power station can learn much from the sales department.

While it is the business of the sales staff to place as many energy-using devices on the system as possible, some knowledge of the company's operating problems, and especially of the load curve, gives an appreciation of the off-peak situation which is worth having, and at least indicates the direction in which some of the most profitable business of the company should be sought. In going about a system, salesmen who are able to answer a few elementary questions about their plants and lines are a real asset to the company. There are many people who are interested in these matters, so rapid has been the spread of applied science within the past decade or two, and sometimes it is an immense help toward the increase of electric service if a customer can be taken to the generating plant by the salesman and the essentials of its equipment and operating organization set forth for his benefit. One of the most striking points which can thus be brought home to the customer is the compactness of the modern turbo-unit compared with the previous engine-driven equipment. When the power solicitor, for example, shows a "prospect" a turbo-alternator of 15,000-kw. rating standing in a space probably no larger than is required by a 2000-kw. vertical engine-driven set, it is easier to explain why power can be generated more economically in large units, other things being equal, and how logically central-station service expresses this development in cases where outside power is best for the user. The practice of preparing a loose-leaf outline of the local system, with a few data as to generating capacity, length of lines, etc., for the use of members of the sales department, has worked out very well indeed in cases where it has been tried, and in closer co-operation among different department employees will be found one of the best lines of development for a wider application of a progressive company's service.

Popularizing Electric Service

NOTHING helps spread the popularity of electric service more effectively than an increased sale of household appliances, a wider dependence on the comfort they provide, and a keener appreciation of how great a service electricity renders in our modern scheme of living. The question of how best to sell these goods so that this influence shall be spread is most important, and many still fail to realize that a reputation for costliness is one direct obstacle to making friends. If it is generally believed among the homes in your city that electrical appliances are expensive to buy, this misconception forms a barrier between the company and a very large number of households. It is to the advantage of us all, therefore, that electrical devices for the home should be easy to buy. No way has ever offered such a simple and logical solution of the problem as the easy-payment plan of selling. Actually it is not the cost of the suction sweepers or the washing machines or any other major article of domestic equipment that interferes with a universal sale to every household, for the worth of the device is recognized as sufficient to justify the expenditure. It is the physical difficulty of paying down the considerable necessary sum of money for the purchase that causes the trouble. Make this act of paying "easy" and the situation finds its own adjustment. In any easy-payment plan, however, one point is most essential. The natural pride of every man and woman is involved, and the installment offer, it is generally conceded, should not be held in reserve for those who cannot buy outright. When the offer is advertised widely, however, as an enterprising business policy open to all comers, the installment method of payment meets a ready response that wins new customers and makes new friends for electric service.

Interesting the Public in Electrical Prosperity Week

From all parts of the country come reports of plans and programs under way in preparation for Electrical Prosperity Week—Nov. 29 to Dec. 4—now barely three weeks off. Advance advertising for Prosperity Week has taken many forms—newspaper displays, announcements, electric signs, etc. A detailed account of progress and of some of the latest plans under way is presented on the opposite page. The roof-top electric sign pictured herewith was erected at Waltham, Mass., and is operated from the lines of the Edison Electric Illuminating Company of Boston, which is taking an active part in the observance of the week. The photograph is by Robert E. Mayall of Waltham.

A Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Effect of Elections on Utilities

The general elections held in many States throughout the country on Nov. 2 decided many things of interest to the electrical industry. The new constitution of New York, one provision of which would have made public service commissions judicial bodies, was overwhelmingly defeated. The constitutional amendment drafted by A. Merritt Taylor, director of city transit of Philadelphia, which would confer the necessary authority on that city to finance and establish municipally owned transit facilities, including subway and elevated lines, and provide the necessary municipal machinery for carrying out such work, was carried in Pennsylvania; but Philadelphia elected a council opposed to the program, which will therefore come to naught. Pennsylvania will also have a compulsory workmen's compensation law.

The Republican party swept out the reform administration in the city of Philadelphia, and with it has gone the element so bitterly antagonistic to the gas and electric interests in that city.

The 8½-cent electric-rate ordinance passed by the Cincinnati Council in July was approved in the referendum election held in that city on last Tuesday by 30,000 plurality in a total vote exceeding 80,000. The result was especially gratifying to the electrical interests in view of the attack on the ordinance being based on a demand for a 6-cent maximum rate. As a result of the election, the matter is now left with the Public Utilities Commission of Ohio, which may establish a just and reasonable rate without further interference or delay.

The work of Henry L. Doherty, chairman of the board of directors of the Toledo (Ohio) Railways & Light Company, in the interest of the franchise of that company has gone for naught, the franchise having been defeated by referendum vote. However, the plan to erect a municipal plant in Lorain, now served by Doherty, was defeated.

Voters in Detroit, Mich., rejected the proposition to purchase the city's car lines and properties within the one-fare zone. The plan, which to be successful required a two-thirds majority, received less than 50 per cent of the vote cast.

CONFERENCE ON VALUATION

The Utilities Bureau Plans a Three-Day Convention in Philadelphia at Which Prominent Economists Will Speak

A conference on valuation will be held on Wednesday, Thursday and Friday of next week in the Hotel Adelphia, Philadelphia, under the auspices of the Utilities Bureau, of which Morris L. Cooke is acting director. The tentative program reveals a list of prominent economists, public utility commissioners, engineers, lawyers and municipal executives who have been invited to take part in the deliberations, and the meetings promise to be highly instructive and interesting to managers of utilities. On Nov. 10 topical discussion will center about "The Reproduction Theory." "Original Cost," "Franchise Values" and "Valuing Land" will be considered on Nov. 11, and on Nov. 12 the subjects which will be discussed are "Depreciation," "Going Value" and "Valuation and the Future in Public Utilities."

The complete program is as follows:

FIRST SESSION

Nov. 10, 8 p. m. Presiding officer, Rudolph Blankenburg, Mayor of Philadelphia.

ADDRESSES

Opening remarks, Morris Llewellyn Cooke, Director of Public Works, Philadelphia, acting director of the Utilities Bureau.

"Criticism of Reproduction Theory of Valuation," John M. Eshleman, Lieutenant-Governor of California, former President California Railroad Commission.

"Reproduction Value Versus Fair Value," H. Findlay French, attorney-at-law, Baltimore, Md.

Discussion by Prof. Morris Knowles, consulting engineer, Pittsburgh, Pa., director course in valuation of public utilities, University of Pittsburgh, and H. P. Gillette, consulting engineer, New York City.

Open discussion.

SECOND SESSION

Nov. 11, 10 a. m. Presiding officer, C. W. Kutz, chairman Public Utilities Commission of the District of Columbia.

ADDRESSES

"Actual Cost as a Basis for Fair Value," George W. Anderson, attorney-at-law, Boston, Mass.

"Original Cost as the Chief Basis for Fair Value," Prof. Edward W. Bemis, Board of Supervising Engineers, Chicago; member of the advisory board to the division of valuation of the Interstate Commerce Commission.

Discussion by Dr. Robert H. Whitten, secretary Board of Esti-

mate and Apportionment committee on the city plan, New York City; Henry E. Elrod, engineer, Dallas, Tex., and Edward P. Burch, consulting engineer, Detroit, Mich.

Open discussion.

"The Making and Maintenance of Priced Inventories," Charles L. Pillsbury, chief engineer valuation bureau, Public Utilities Commission, District of Columbia.

Discussion by James W. Phillips, grade-crossing division, Bureau of Survey, Philadelphia; F. W. Ballard, commissioner and chief engineer, Division of Light and Heat, city of Cleveland, Ohio, and R. J. Meigs, Western Union Telegraph Company, New York City.

Open discussion.

THIRD SESSION

Nov. 11, 2.15 p. m. Presiding officer, Dr. L. S. Rowe, president of American Academy of Political and Social Science.

ADDRESS

"Valuation by Approximation," John G. Morse, appraiser Associated Factory Mutual Fire Insurance Companies, Boston, Mass.

Discussion by Morris Llewellyn Cooke, Director of Public Works, Philadelphia, and John R. Freeman, president of Manufacturers' Mutual Fire Insurance Company, Providence, R. I.

"Franchise Values," Delos F. Wilcox, consulting franchise and public utility expert, New York City, Deputy Commissioner Department of Water Supply, Gas and Electricity.

Discussion by Henry De Forest Baldwin, president and counsel of the Queens County Water Company, New York City; Chester A. McLain, lecturer, Harvard University, and Alfred Bettman, attorney-at-law, Cincinnati, Ohio.

Open discussion.

FOURTH SESSION

Nov. 11, 8.15 p. m. Topic, "Land Values."

ADDRESS

"Principles to Be Applied in Valuing Land," Hammond V. Hayes, consulting engineer, Boston, Mass.

Discussion by Henry DeForest Baldwin, president and counsel of the Queens County Water Company, New York City; Edward W. Doty, with Columbus (Ohio) Railway, Power & Light Company, former member the Public Utilities Commission of Ohio; F. W. Stevens, general valuation counsel, New York Central Lines, New York City, and Milo R. Maltbie, member of the advisory board to the division of valuation of the Interstate Commerce Commission.

Open discussion.

FIFTH SESSION

Nov. 12, 10 p. m. Presiding officer, Frederic P. Stearns, consulting engineer, Boston, Mass.

ADDRESSES

"Court Decisions on Depreciation," J. H. Goetz, of counsel, Public Service Commission, First District, New York City.

"Depreciation as a Factor in Fair Value," Halford Erickson, chairman of Wisconsin Railroad Commission.

Discussion by Leonard Metcalf, consulting engineer, Boston, Mass.; Lester M. Sears, consulting engineer, Detroit, Mich; James E. Allison, consulting engineer, St. Louis, Mo.; Philip J. Kealy, board of control, Kansas City Railways Company, Kansas City, Mo., and Prof. John Bauer, Cornell University.

Open discussion.

SIXTH SESSION

Nov. 12, 2.15 p. m. Presiding officer, Morris Schaff, Massachusetts Board of Gas and Electric Light Commissioners

ADDRESS

"Going Value as an Element in Fair Value," Clifford Thorne, chairman Iowa Board of Railroad Commissioners.

Discussion by Ray Palmer, consulting engineer, Long Island City; A. M. Fox, engineer for telephone committee, Detroit, Mich.; Prof. C. E. Merriam, University of Chicago, and William J. Hagenah, Public Utility statistician, Chicago, Ill.

Open discussion.

SEVENTH SESSION

Dinner, Nov. 12, 6.30 p. m. Presiding officer, Dr. Charles R. Van Hise, president, University of Wisconsin.

ADDRESSES

"The Meaning of the Constitutional Protection in Valuation," Charles A. Prouty, director of valuation, Interstate Commerce Commission.

"Constitutional Protection in Valuation," William D. Kerr, attorney-at-law, Chicago, Ill.

Discussion by Newton D. Baker, Mayor of Cleveland, Ohio; Joseph B. Eastman, Public Service Commission, Boston, Mass., and A. L. Valentine, superintendent Department of Public Utilities, Seattle, Wash. (To be presented in *Proceedings.*)

"Opinion Testimony," Prof. John H. Gray, University of Minnesota.

"Valuation and the Future in Public Utilities," Milo R. Maltbie, member of the advisory board to the division of valuation of the Interstate Commerce Commission.

ELECTRICAL PROSPERITY WEEK OUTLOOK

Indications of Record-Breaking Sales in Plans Formulated by Electrical Interests in Various Sections of the Country

Plans for "cashing in" on Electrical Prosperity Week —Nov. 29-Dec. 4—have been fully developed. Workmen in hundreds of cities throughout the nation are actively engaged upon the construction features, while committees and executives are giving the final touch to arrangements which will enable the event to measure up to expectations.

Brooklyn, N. Y., is to have an electrical show. Another feature will be a far-reaching house-wiring campaign conducted by the Edison Electric Illuminating Company of Brooklyn in conjunction with the contractors, as announced in these columns last week. Electrical dealers will co-operate by window displays designed especially for the week, and the public interest in the celebration will be further intensified by illumination of prominent buildings and arches.

In Philadelphia the electrical interests will conduct a wiring campaign in which a discount of $1 per outlet will be allowed on the wiring of all ready-built dwellings and stores. The Philadelphia Electric Company will hold special appliance exhibits and demonstrations, including window displays and exterior decorations. Advertising giving publicity to Electrical Prosperity Week and to electricity in general will be conducted in the street cars. The newspaper advertising of the electrical interests will also be greatly increased. Plans are also under way in Philadelphia to construct four allegorical, electrically lighted floats to parade in various sections of the city on different nights during the week. One float will be devoted to general lamp illumination; another will depict allegorically electric power; a third will be devoted to a general figurative display of illumination, while the fourth float, with the assistance of a trailer, will give motion-picture demonstrations of domestic applications of electricity.

Plans for participation in the celebration are now under active consideration by the electrical men of Buffalo, N. Y. The enthusiasm which has been shown in the various meetings held to discuss the proposition indicates that Buffalo will be on the "cash-in" line when the week comes.

Milwaukee, Wis., is to have various demonstration and display features of an interesting and instructive nature. The celebration will be featured in newspaper and billboard advertising. One of the features will be a construction car of the railway company, which will be decorated and kept on the streets every day during the week. Another feature will consist of film exhibitions at the motion-picture houses.

In Cincinnati, Ohio, it is planned to light all the large office buildings from 7.30 to 9.30 every night of Electrical Prosperity Week. An electrical show will also be held, in which most of the electrical interests of that locality will participate.

It is announced by the Denver Gas & Electric Light Company that a grand celebration will be held in Denver, the climax being a prosperity show to be held on the last four days of the week under the auspices of the Colorado Electric Club. An electric-automobile parade is also contemplated. Various spectacular features are being prepared which are likely to draw crowds to the electrical show and its vicinity. Some of the features planned are the showing by wireless, on a miniature scale, of the maneuvers of a battleship, a fac-simile of a submarine, an aerial or Zeppelin battle, and various high-frequency electrical-discharge features of a nature to interest the public.

Among the foremost boosters for Electrical Prosperity Week are the electrical interests of Salt Lake

City, Utah. Flood-lighting of the capitol in Salt Lake City is the feature of a series of novel illuminations arranged by Utah's committee. During the week searchlights will play about the city and on the mountains. In the comprehensive program reported by Secretary A. R. Loughborough of the Western Electric Company the committee includes an electric show, lighting of all office buildings, an electric-vehicle endurance run, guessing contests on the amount of candle-power in some unusual lighting display, and demonstrations in the University of Utah and in the domestic-science department of the Agricultural College of Utah. The "cornerstone" of Salt Lake City's new "white way" will also be laid during the week. The committee has decided that its "drive" will be: "Make your Christmas present an electrical one."

The Louisville Gas & Electric Company reports that an amusement company has been formed to hold a festival at the armory in that city, under the auspices of the Jovians. The electrical interests will maintain attractive exhibits, featuring things electrical. An electrical parade will also be held of which a large number of electric vehicles of various types will form a prominent part. The local organization of boy scouts will march in the parade, each boy carrying an electric lantern.

Thus far definite plans have been formulated for holding electrical shows in more than twenty-two leading cities of the United States. Many others have this feature under serious consideration. Many mayors of cities, together with many civic organizations, have indorsed the plan and are actively engaged in carrying out various measures for its support.

Electrical interests are enthusiastic over the celebration, and the event is expected to surpass all trade movements conducted heretofore and to prove highly creditable to the electrical industry.

Formation of Utilities Commission to Come Before Kentucky Legislature Again

A bill creating a public utilities commission will be brought before the 1916 session of the Kentucky Legislature, but what success will attend the measure cannot be stated as the Legislature has not been canvassed regarding the matter. A public utilities commission for Kentucky has been advocated for several years by many prominent men, and an attempt was made in 1912 to establish such a commission, but the bill was defeated. The matter of fixing the assessment of the various public utilities is handled in Kentucky by the State Board of Assessment and Valuation, composed of the Auditor, the Treasurer and the Secretary of State. This board for the last four years has materially increased the assessment of the various public utilities in Kentucky, and it is the opinion of Secretary of State C. F. Crecelius that, when properly handled, the State Board of Assessment and Valuation can deal with these matters as well as a public service commission.

Indefinite Franchise Not Perpetual in Ohio

By a decision handed down by the Ohio Supreme Court, Oct. 19, the Northern Ohio Traction & Light Company is ousted from Stark County. The general effect of the court's decision is to establish definitely the principle that a public utility franchise granted originally for an indefinite period may be terminated at will by either the company or the subdivision which gave the franchise. The specific object of the fight in Stark County against the traction and light company was to secure a reduction of fare between Canton and Massillon from 15 cents to 10 cents, and to secure with this fare transfers on local lines in both cities.

The case was instituted in the Supreme Court, April 2, 1913. Previously the Court of Appeals of Stark County had rendered judgment in favor of the company in ouster proceedings started by the prosecuting attorney on instructions of the Stark County commissioners. The Court of Appeals' decision, rendered April 1, 1913, is overruled inferentially by the Supreme Court. The franchise was given the company by the county commissioners in 1892 for an indefinite period. The company claimed the right to hold the franchise perpetually.

SAFETY RULES FOR THE INDUSTRY

Committee Conferences with Bureau of Standards in New York Terminated This Week

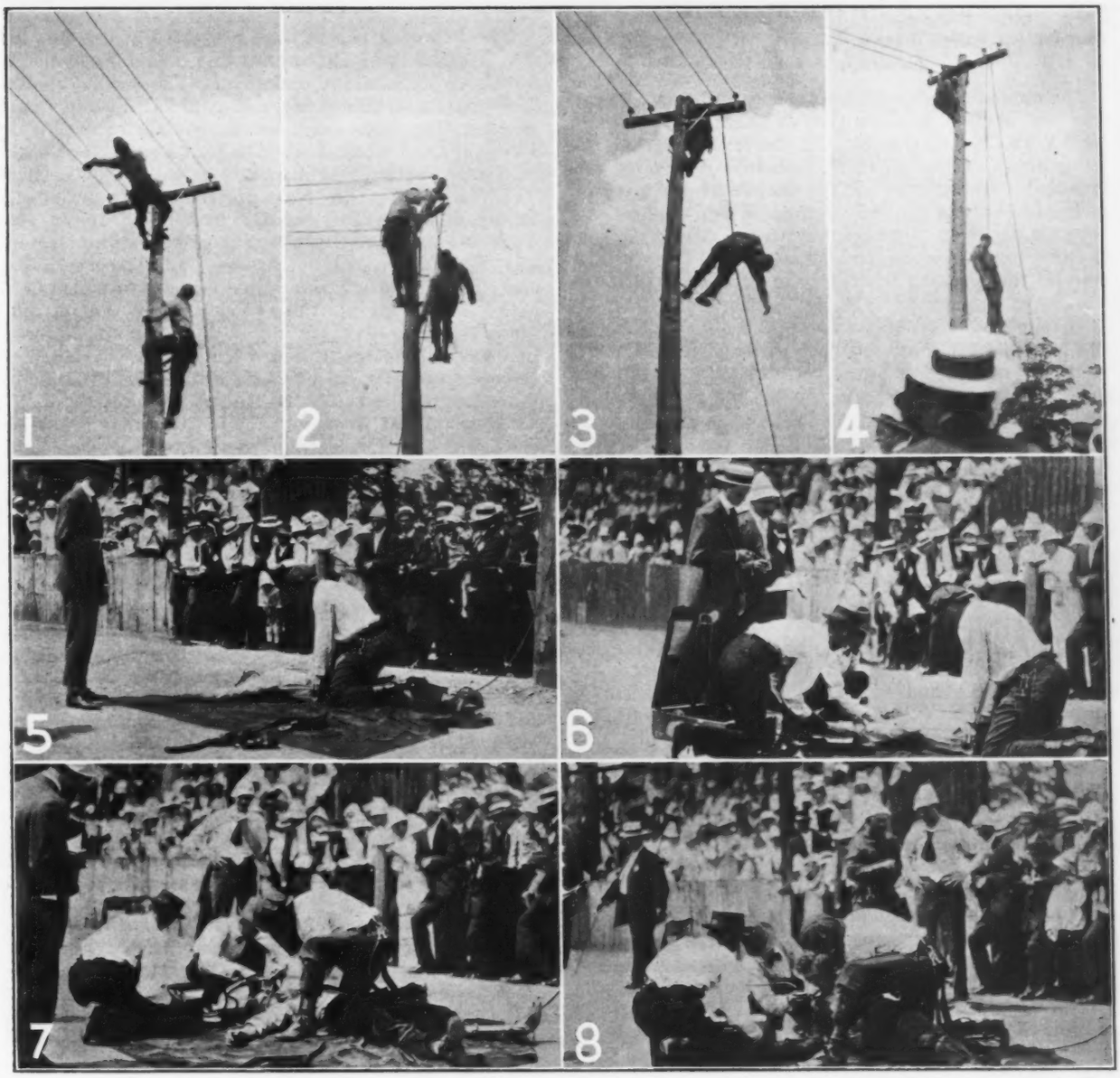
The conference on the proposed safety code of the Bureau of Standards which has been in session at the headquarters of the American Institute of Electrical Engineers in New York City, although still in session at the time the ELECTRICAL WORLD went to press, will conclude its work this week. The sub-committees on stations, line, utilization and operation have been in almost constant session, morning, noon and night, during the past two weeks and continued their deliberations on mooted points until a general agreement in each of the sub-committees on these points was reached. The greater part of the work assigned to the sub-committees on station, utilization and operation was completed Thursday, and it was expected that the line sub-committee would also be able to make its report.

A great deal of misunderstanding arose over interpretations of the safety code, and much of this was eliminated by re-wording those paragraphs dealing with the scope of the rules. It was made plain by the representatives of the Bureau of Standards that the code is not intended to be enforced in an arbitrary or inflexible manner by commissions or others having jurisdiction but is intended more as a complete specification of good practice in the electrical industry so far as safety is concerned.

Some difficulty was experienced in harmonizing the viewpoints of conflicting interests, telephone, railroad and lighting, and while the code was not changed greatly in principle, a number of alternate methods were adopted to meet variations in practice in various sections of the country. Some very important modifications were effected especially in the grounding of low-potential circuits, the potential at which grounding has been made mandatory being raised from 150 volts to 300 volts. Moreover, telephone companies will have to protect against constant-potential systems of 7500 volts instead of 5000 volts, and the limit on constant-current circuits will probably be raised from 7.5 amp. to 10 amp.

When the conference is finished revised copies of the proposed code will be submitted within a few weeks to the members of the industry taking part in it and to a limited number of others, after which the Bureau of Standards will take up the matter with the public service commissions and municipalities. From the situation as it is at present it is doubtful whether the Bureau of Standards will be able to hold a public conference on the code in Washington until after Jan. 1.

All of the delegates present, including those representing the Bureau of Standards, have expressed themselves as highly pleased with the results so far attained. The conference has been a costly one to the industry, representing in the salaries and expenses of those engaged in it an outlay of approximately $25,000.



A Contest in Rescue and Resuscitation Work Between Line Crews

An innovation in contests held by the Duquesne Light Company Section of the National Electric Light Association at its annual outing this summer was a first-aid contest between teams of linemen from each of the nine districts of the organization. Two 35-ft. poles, erected 150 ft. apart, with their cross-arms and wires, represented a section of a line. The plan of the action was as follows: One lineman at the top of each pole is suddenly shocked and falls back upon his safety strap. Immediately the rescue work begins. One of the team ascends the pole, ties his handline about the victim's waist, and throws the line over the cross-arm and to the ground. The third man lowers the victim. Meanwhile a fourth man has telephoned for a doctor and has then hastened to the wagon for the pulmotor, bringing it to the victim, who has already been laid on a blanket. The prone-pressure method of resuscitation is then applied.

The first four pictures show the work of rescue, No. 5 illustrates the prone-pressure method, No. 6 shows the victim ready for the pulmotor, No. 7 shows the pulmotor in operation, and in No. 8 the victim is seen inhaling oxygen after resuscitation.

The work of each team was judged on four counts, as follows: Rescue, prone-pressure work, pulmotor application, and team work.

In the rescue work the time element was considered the most important factor. Remarkable speed was shown by the teams. From the time the victim was shocked to the time his body reached the ground the following number of seconds was consumed by the teams: 40, 45, 50, 59, 60, 60, 65 and 77. During this time one man donned rubber gloves, ascended the pole, hooked his safety strap in place, tied the rope about the victim's body, released the victim's safety strap, signaled the man on the ground to lower the body, and the body was lowered. Such speed seems incredible, but stop-watches proved the accuracy of the count. Demerits were given on this work for the lack of rubber gloves, touching the wires by the rescuer, dangerous speed in lowering the body, failure to give the correct telephone number of one of the company's doctors in the district represented by the team, loss of time in the rescue, and bungling work on the pole.

In the prone-pressure work demerits were given for incorrect position of the hands of the operator and of the operator's body, too rapid or too infrequent applications of the pressure, incorrect position of the victim's face, and failure to clear the victim's mouth.

The application of the pulmotor was begun directly after the administration of the prone-pressure work and at the word of the prone-pressure judge. In this, demerits were given for failure of the team mate who brought the pulmotor from the wagon to bring the extra oxygen tank, for failure to clean out the mouth, to go through the form of pulling out the tongue with the clamps, to attach the face mask properly, to secure proper speed of the operation of the pulmotor, to throw over the valve when the mask was removed and the inhalator used, and to place a coat under the victim's head.

The McKeesport team was declared the winner with a total of 91 points, Wilkinsburg was next with 90 points, and the others stood as follows: East End, 88; Rankin, 87; Esplen, 83; North Side, 82; Thirteenth Street, 78, and Bellevue, 70. The members of the winning team were presented with bronze medals, appropriately inscribed. H. N. Muller, superintendent of distribution, originated the contest, and C. W. Ward was chairman of the committee.

AMERICAN PHYSICAL SOCIETY

Illumination Topics Discussed at Oct. 30 Meeting at Columbia University, New York City

The annual meeting of the American Physical Society was held in Fayerweather Hall of Columbia University, New York City, on Oct. 30. An elaborate program, covering many of the different branches of physics, was provided. On account of the length of the program each address was limited in time to ten minutes.

In his paper on "Radiation from Tungsten Filaments and the Mechanical Equivalent of Light," Irving Langmuir of the research laboratory of the General Electric Company, Schenectady, N. Y., pointed out that the resistivity, radiant energy (watts per square centimeter) and intrinsic brilliancy (candles per square centimeter) of tungsten filaments have been determined over wide ranges of temperature up to the melting point of tungsten, 3560 deg. K. The resistivity increases quite accurately with the 1.24th power of the temperature, while the corresponding exponent for the energy radiated is variable and decreases from 5.6 at 1000 deg. to 4.75 at 3500 deg. K. Under normal operating conditions (1 watt per candle in vacuum) tungsten radiates 32 per cent as much energy as a black body at the same temperature. The light radiated from tungsten is bluer than that from a black body at the same temperature and matches that from a black body at a temperature from 50 to 80 deg. higher. By comparing the measurements of brilliancy with a result calculated from the Planck equation and visibility curve, the mechanical equivalent of light is found to be 0.00121 watt per lumen, or 0.0152 watt per mean spherical candle.

Heat Conductivity of Tungsten

A second paper by Dr. Langmuir, on "Heat Conductivity of Tungsten at High Temperatures and the Wiedemann-Franz Relation," showed that by a development of the mathematical theory of the temperature distribution along a tungsten filament near a cooling junction it has been possible to recalculate the heat conductivity of tungsten from the experimental data of Worthing. The new result is 1.14 watts per centimeter per degree at 2200 deg. K. and is practically independent of the temperature. The relation between the heat conductivity and the electrical conductivity is thus found to be in good agreement with that which has been obtained with other metals.

"The Theory of the Flicker Photometer" was the subject of a paper by Herbert E. Ives and E. F. Kingsbury of the United Gas Improvement Company, Philadelphia, Pa. In a paper published a year ago the authors showed that certain characteristic phenomena of the flicker photometer can be explained by assuming that the transmission of light stimuli by the retina is in accordance with the Fourier diffusion law. If the "diffusivity" varies with the logarithm of the illumination and the receiving mechanism is governed in its sensibility by the Weber-Fechner law, the behavior of the flicker photometer may be worked out as a problem in heat conduction.

Thus far the only problems considered have dealt with the conditions at the point of equality setting of the photometer. In the new paper conditions at other points are studied, by applications of the same theory. Among the topics treated are the sensibility of the flicker photometer, the effects of superposed steady and flickering illuminations, critical frequency illumination relations for various angular openings, the flicker photometer with unequal exposures of the compared colors, and the effects of mechanical irregularities in the photometer field. Some new phenomena are predicted and found for low illuminations.

Program of Papers

The following papers were presented at the meeting: "A Modified Form of the Moving Lamp Photometer," by C. C. Trowbridge and W. B. Truesdell, Columbia University; "Demonstration of a Model Visibly Representing Gas Molecules," by E. F. Northrup, Palmer Physical Laboratory, Princeton University; "The Fields of Force Surrounding Atoms," by Albert C. Crehore, Yonkers, N. Y.; "A New Method of Analyzing the Motion of a Vibrating String," by W. S. Franklin, New York, N. Y.; "The Theory of the Flicker Photometer," (2) "Unsymmetrical Conditions," by Herbert E. Ives and E. F. Kingsbury, the United Gas Improvement Company, Philadelphia; "The Velocity of Polymorphic Changes Under Pressure," by P. W. Bridgman, Jefferson Physical Laboratory, Harvard University; "Axial Interference Figures from Brookite with Light of Different Wave-Lengths," by John B. Taylor, Schenectady, N. Y.; "A New Line of Argument for the Rigorous Establishment of the Idea of Entropy as a Measurable Quantity," by W. S. Franklin and Barry McNutt, Lehigh University; "A New Type of String Galvanometer," by Horatio B. Williams, Columbia University; "Some Data on the Absorbed Charge in Electric Condensers," by Anthony Zeleny, University of Minnesota; "The Temperature Coefficient of Contact Potential," by Karl T. Compton, Princeton University; "Equipartition of Energy and Radiation Theory," by W. F. G. Swann, Carnegie Institution of Washington; "Planck's Radiation Formula Deduced from Hypotheses Suggested by X-Ray Phenomena," by William Duane, Harvard University Medical School; "The Relations of the Photo Potentials Assumed by Different Metals When Stimulated by Light of a Given Frequency," by A. E. Hennings, University of Saskatchewan, and W. H. Kadesch, United States Naval Academy; "Radiation from Tungsten Filaments and the Mechanical Equivalent of Heat," by Irving Langmuir, General Electric Company, research laboratory, Schenectady, N. Y.; "The Construction of Compound Molecules by Means of the Fields of Force, Especially the Systems of Growth of the Organic Compounds of Hydrogen and Carbon," by Albert C. Crehore, Yonkers, N. Y.; "Some New Measurements on the Thermometric Movement of Tree Branches," by C. C. Trowbridge, Columbia University; "An Interesting Phenomenon of Wave Motion," by W. S. Franklin, New York, N. Y.; "The Value of '*h*' Determined Photoelectrically from the Ordinary Metals," by W. H. Kadesch, United States Naval Academy, and A. E. Hennings, University of Saskatchewan; "Heat Conductivity of Tungsten at High Temperatures and the Wiedemann-Franz Relation," by Irving Langmuir, General Electric Company, research laboratory, Schenectady, N. Y.; "Atomic Groups in Solids as Indicated by Their Thermal Conductivities," by Arthur H. Compton, Princeton University; "A Relation Between the Melting Points of Substances and Their Heats of Formation," by Arthur H. Compton, Princeton University; "Negative Resistance," by Albert W. Hull, General Electric Company, research laboratory, Schenectady, N. Y.

Additional Papers

The following papers were added to the original program: "Note on an Atomic Model Giving a Spectrum Series with Constant Frequency Intervals," by Ernest Merritt, Cornell University; "Resistance and Thermoelectric Power of Oxides of Iron," by Charles C. Bidwell, Cornell University; "Turbine Type of Molecular Pump," by George B. Pegram, Columbia University; "Einstein's Photoelectric Equation and Contact Emf.," by Robert A. Millikan, University of Chicago, and "A New Derivation of Planck's Radiation Formula," by Leigh Page, Yale University.

Copper and the Electrical Industry

Unusual Conditions in the Market as the Result of the European War—The Outlook for the Future

COPPER affects the cost accounts in all electrical construction. At all times it is a necessary element in construction, an unavoidable element in cost. The extraordinary conditions of production and the present large demand for the red metal in unusual channels of use create a situation which has an important bearing on electrical industries. With electrolytic copper at about 18 cents per pound and the customary complex influences in the market vastly multiplied by the European war, it is natural that electrical consumers should study with great interest all signs which may foreshadow the future course of prices. A representative of the ELECTRICAL WORLD asked for the views of a number of those who are interested in the consumption of copper by the electrical industries. This canvass covered not only consumers within the electrical industry but also producers who keep close watch upon the demand for electrical purposes. It included representatives of electrical manufacturers and central stations, purchasing agents, engineers, producers and smelting interests.

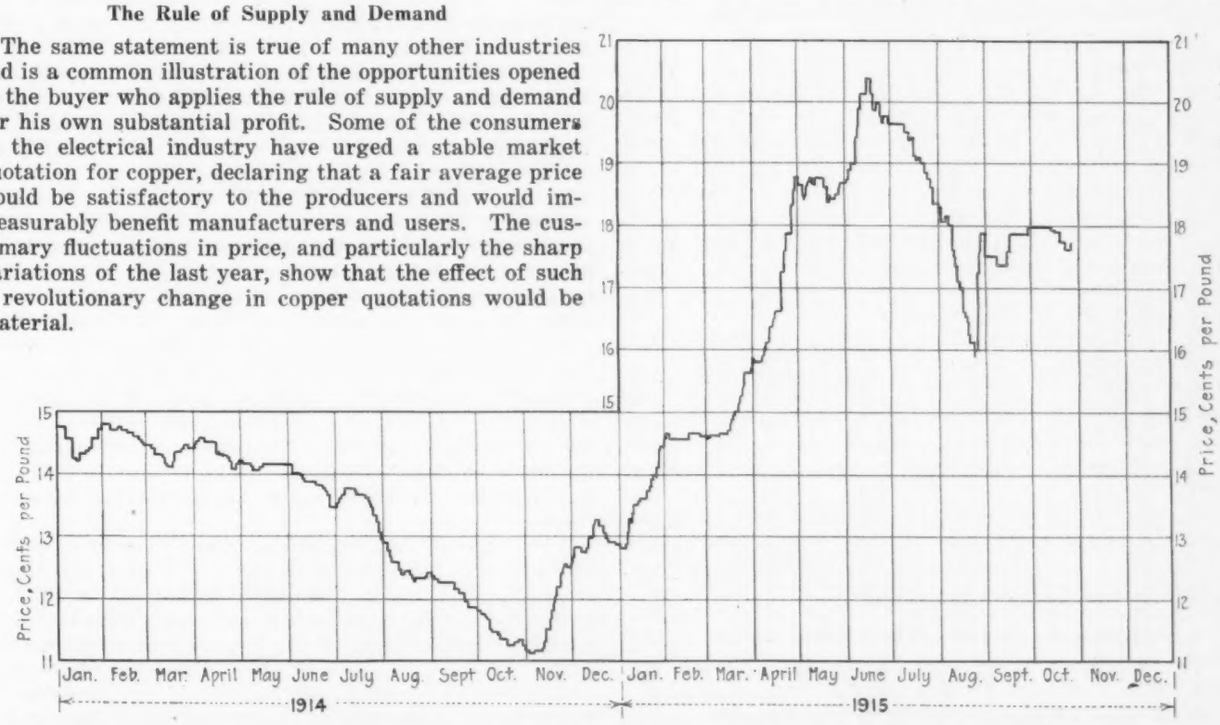
The purchase of copper is so large an influence in costs at all times that it is well worth the constant study of heavy buyers for electrical consumption. That this is so is proved conclusively by experience in normal years, and it is especially important in the combination of changing circumstances which at present surrounds both the electrical industry and the copper market. A representative of a large copper-producing interest said to the ELECTRICAL WORLD: "We find that our demand always comes when the price is high." The same condition existed in steel rails before the price per ton was made stable.

The Rule of Supply and Demand

The same statement is true of many other industries and is a common illustration of the opportunities opened to the buyer who applies the rule of supply and demand for his own substantial profit. Some of the consumers in the electrical industry have urged a stable market quotation for copper, declaring that a fair average price would be satisfactory to the producers and would immeasurably benefit manufacturers and users. The customary fluctuations in price, and particularly the sharp variations of the last year, show that the effect of such a revolutionary change in copper quotations would be material.

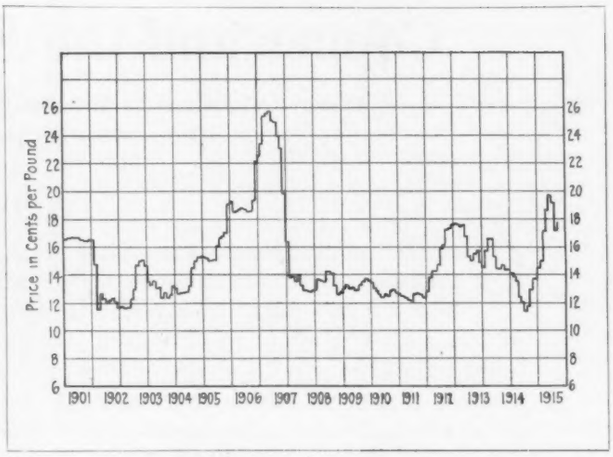
Conditions Prior to Outbreak of the War

Consumption of copper was not normal in the first half of the year 1914. Industrial activities were lessened in both this country and Europe, and the price of copper sagged under the reduced demand. When the war was started everybody feared paralysis in domestic business. Copper producers curtailed production radically, the price went down, and finally even the publication of quotations was abandoned on the general understanding that no market worthy of the name existed. The Copper Producers' Association discontinued the publication of statistics and was disbanded. In the



SHARP FLUCTUATIONS, CAUSED BY THE EUROPEAN WAR, IN THE AVERAGE DAILY PRICE OF ELECTROLYTIC COPPER IN NEW YORK—THE LOW POINT WAS REACHED THREE MONTHS AFTER WAR BROKE OUT, AND A NEW HIGH LEVEL WAS ESTABLISHED ABOUT EIGHT MONTHS LATER

A MODERN COPPER MINING AND CONCENTRATING PLANT—PROPERTY OF THE UTAH COPPER COMPANY NEAR SALT LAKE CITY



HOW THE AVERAGE MONTHLY PRICE OF ELECTROLYTIC COPPER IN NEW YORK SINCE 1901 COMPARES WITH THE RANGE DURING THE WAR

electrical industry purchases of copper in the summer and closing months of 1914 were very light. Apprehensions concerning the business outlook and the difficulty of selling securities to raise capital for extensions combined to enforce caution. Then there followed the unexpected purchases of copper for munitions of war, the quick advance in the price from a little over 11 cents to 20 cents, and the consequent powerful stimulation of production.

With the output of copper at a very high level, if not the highest in the history of the country, with the current price higher than most electrical consumers regard as inviting, with all copper producers keenly looking for another wave of very heavy buying orders for munitions of war, and with general domestic business showing decided improvement, the possibilities are full of deep interest.

Electrical Buying Will Regain Importance

The usual concern of the electrical industry in the copper market is intensified sharply by the war. When hostilities were started the lessened buying for electrical uses was one of the factors in the rapid demoralization of prices. Now, with the enormous temporary demand for copper in munitions of war the position of electrical buyers is of less consequence to producers. But when peace is in sight the attitude of consumers in the electrical industries—representing as they do a large, sure and permanent market—will regain importance as a factor in the price and production of the red metal.

As a dominating factor in both price and consumption the European war far excels in importance any other influence of the past. It has created entirely new conditions in the last fifteen months, and its overshadowing power controls all speculations as to the future. Under normal conditions from 50 per cent to 60 per cent of the output of copper in this country is exported. Of the remainder it is estimated that in the neighborhood of one-half—that is to say, between 20 per cent and 25 per cent of the total production—finds its ultimate destination in the electrical industries.

High Level Lessens Public Utility Buying

The proportion used in the electrical industries has been altered during the war, partly on account of the reduced rate of capital expansion and in part because a high price level for copper always lessens buying by the public utilities. Just what proportion of the present production reaches the electrical public utility consumers it is difficult to judge. In general, the producers hold that war munitions are absorbing easily what public utilities would be buying if conditions were normal. This conclusion, of course, deals only with current production and orders. It does not take into consideration the fact that large purchases were made for some public utility consumers when copper stood at low prices last year. Such purchases have provided for many needs of the current year, making it unnecessary for the fortunate buyers to go into the market at the present level of prices.

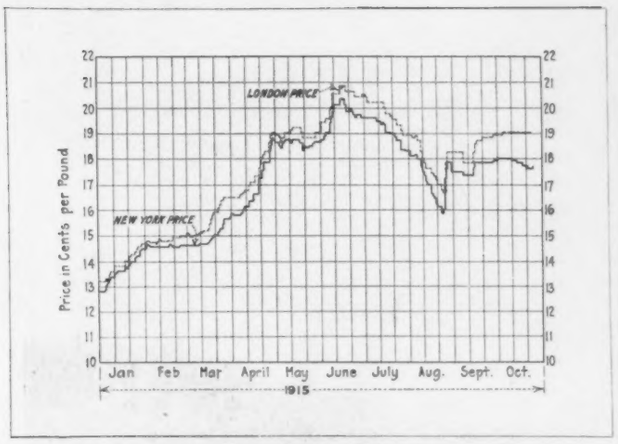
One copper-producing interest expressed the opinion that, with the exception of electric central stations, the public utilities are making now practically no purchases of copper. His estimate is that electric central stations are buying about 10 per cent of what would be their normal requirements if they were expanding freely. This estimate suggests a serious disturbance in underlying business conditions, whereas the fact is that the gross business of the central-station industry of the entire country is showing good average gains. The factor that is not normal is the market for securities, although that market has been showing substantial improvement.

When Copper Is a Good Purchase

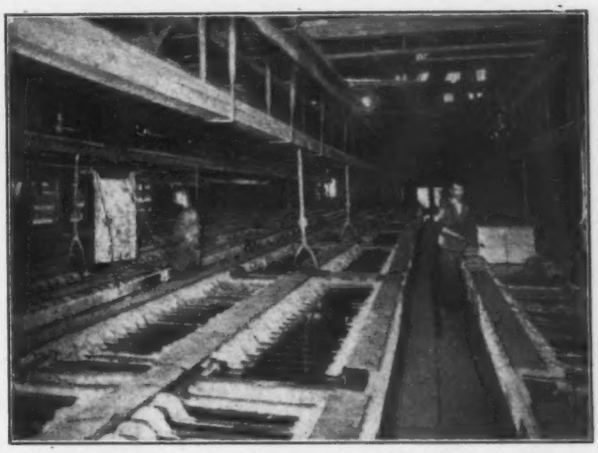
Another point that bears on reduced buying for electrical consumption is that when copper attains a level equal to the present one many central-station officials decline to buy unless they are in absolute need of materials. It is the practice among some central stations to confine purchases as far as possible to periods when copper is at 15 cents or under. The judgment of one prominent engineer was expressed in this way: "Copper at any price under 15 cents is a good purchase for a central station. If the price reaches 16 or 17 cents, and we require materials, we do not hesitate to buy, but if it gets to 18 cents or higher we keep away from the market."

Very similar views were expressed by others representing large consumption of copper for electrical properties. An official of a holding company told about his policy of carrying small stocks and of drawing on them without replenishment if the price advanced above 18 cents. In his judgment any price under 15 cents is low and anything above 18 cents is high, while between those figures purchases are advisable under some business conditions.

Much of the buying of copper or of materials in which copper is a large factor is concentrated in New York,



NEW YORK AND LONDON AVERAGE DAILY PRICES OF ELECTROLYTIC COPPER FOR THE FIRST TEN MONTHS OF THE PRESENT YEAR



ELECTROLYTIC CELLS FOR REFINING COPPER—THREE-QUARTERS OF THE WORLD'S SUPPLY IS REFINED ON THE SHORES OF NEW YORK HARBOR

particularly for holding companies controlling groups of operating properties of medium or small size. In certain instances, however, it has been found to be as economical to let the operating companies do their own buying. Combined buying is conducted for some groups of properties because of a centralized purchasing department which has as one of its main activities the constant study of conditions and statistics of the world-wide situation in the copper market. The extremes of possibilities opened in the copper market are indicated by the experiences of two generating companies in past years. One built a long transmission line when it was able to buy drawn copper wire at 12 cents. The other found it expedient to make an extension at a time when copper was selling at 26 cents.

Copper in Valuation

The question of costs was discussed by one executive in relation to valuation. He said that it is difficult to control the time of extensions of lines in all cases because demands for facilities have to be met when they arise. A public service commission, according to the view expressed, would accept accurate records of exact cost without regard to the price paid for materials if it was demonstrated that extensions were necessary. If full cost records are not preserved carefully, the commissions, in making a valuation, use the average price during a period of, say, five years. This practice deprives a company of part of the capital investment made at a price above the average, although, of course, it might be offset by an allowance of an average price which is above actual cost for an extension built when material prices were low.

Officials of public utilities that buy only as their requirements develop say that they do not want to speculate in copper. They feel that they are justified in making little or no effort to concentrate purchases in periods of low price and light demand. Their rates, of course, are not subject to fluctuation with the price of copper as are the prices of manufacturers of materials in which copper is a large element.

Manufacturing Costs and Prices

It is a simpler matter for wire companies to change their price schedules with the movement of copper than for manufacturers of apparatus and appliances to do so. While the proportion of copper varies in different classes of apparatus, it is an element of cost on which manufacturers have to figure closely, especially on competitive business. For this reason some manufacturers buy enough copper in the market to provide for each specific order, but protect themselves further by keeping a supply of the metal on hand as a reserve. Every fluctuation of 1 cent in the price makes a percentage increase or decrease, the amount of which can be stated approximately, in the costs of some manufactured materials.

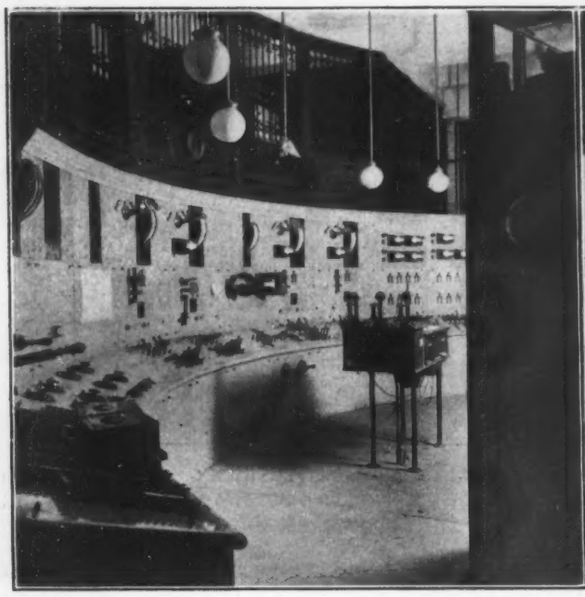
Some of the copper production of the last year and a quarter has been taken by electrical manufacturing plants which are using part of their resources for making munitions of war, but this represents activities which are materially different from the regular business of these establishments. The plants are well equipped to care for this business, and the lull in the demand for electrical apparatus has enabled them to extend their activities without detriment to their usual avenues of distribution.

The Complex Future Prospects

Future prospects in the copper market are made complex by the many unprecedented factors. With the seas open for shipments to the Allies the copper producers look for an uninterrupted demand from that source. After the conclusion of the war copper authorities expect immediate enormous orders from Europe to restore destroyed properties and to replenish the depleted stocks in Germany. A point about which they are uncertain is the demand from public utilities and other consumers in this country.

Future purchases by public utilities and by manufacturers who find their main markets in those properties are dependent chiefly on the market for securities. New construction, which calls for the most material, cannot be undertaken on an important scale unless capital securities can be sold. These securities will find a market only at rates that compare favorably with the returns on other securities. The question of what rates will have to be offered is undergoing discussion at present as a result of conditions in the investment market which were revealed by the Anglo-French loan at a net yield of 6 per cent.

The problem of the rate of return, however, is only one of those to be met. Another is the reluctance of electrical properties, as indicated above, to make capital extensions when the price of copper is as high as 18 cents. In the face of an expected demand from Europe the producers may prefer to hold their prices and output to meet that rather than to lower the quotation in order to invite buying from electrical consumers. A decline in the price level would tend to stimulate purchases for electrical properties.



FIGS. 1 AND 2—CONTROL SWITCHBOARD AND PART OF THE DIRECT-CURRENT SWITCHING APPARATUS IN THE NEW YORK EDISON COMPANY'S NEW THIRTY-NINTH STREET SUBSTATION

Substation to Serve New York Theater District

Arrangement of Equipment to Economize in Copper and Duct Construction—Large Storage-Battery Reserve to Insure Continuous Service—Operating Methods

DURING the past few months the New York Edison Company has placed in operation a new substation situated on West Thirty-ninth Street, between Broadway and Sixth Avenue, in the heart of the theater district. This substation was erected on the site of the old West Thirty-ninth Street substation, which was originally a steam generating station, subsequently transformed into a rotary-converter substation of 8500 kw. rating. This new substation, built to supply the increased demand, will have an ultimate rating of 28,000 kw. and supplies one of the most important load districts in New York City. Included in its area of supply are fifteen of New York's largest and most prominent theaters, among them the Metropolitan Opera House and the Hippodrome. In view of panics which might occur in these large gathering places should the lights fail, the New York Edison Company has striven to obtain a design of substation which will assure continuity of service under all conditions.

The design is a departure from the ordinary practice of mounting switchboards and main transformers on the same floor with or above the rotary converters in that the switchboards and main transformers are installed below the rotary converters. The saving in cost of cables, conduits and building due to this arrangement will amount to about $100,000 for the completed station.

Provisions have been made for three large storage batteries, one on each floor, which will be capable of carrying 35 per cent of the maximum load for one hour, or the maximum load for a period of about fifteen minutes. A load curve for a characteristic winter day is shown in Fig. 7.

Structural Features to Effect Economy

The substation is constructed on a lot 50 ft. by 100 ft. and will ultimately contain eight 3500-kw. rotary converters, three storage batteries with a combined rating of 9600 kw. for one hour, and 140 low-tension direct-current feeders of 1,000,000 circ. mils each. Figs. 3 and 5 show a transverse and a longitudinal cross-section respectively.

In the basement are the low-tension direct-current switchboard, the main transformers, and the control board for the rotary converters, batteries and high-tension switching apparatus. The low-tension switchboard being considerably below the level of the street, the direct-current feeder cables after leaving the switches have only a very short drop before turning horizontally into the ducts leading to the manholes, of which there are eight—in front of the station—thereby saving a great deal of heavy cable and conduit construction.

The transformers in the basement are between concrete piers forming part of the foundations of the rotary converters. These piers serve as barriers between the transformers, and in case of a burn-out would localize the trouble. This construction is shown in Fig. 6. On a mezzanine floor above the basement are a booster set for charging the batteries and compartments containing the remote-controlled field rheostats and starting-apparatus resistors used with the rotary converters.

On the floor above the rotary converters are installed, and from their direct-current terminals heavy cable connections in conduits drop down in a direct run to the circuit-breakers over the rotary-converter switches. The alternating-current leads from the rotary converters are composed of copper bars and drop almost vertically to the transformers below, which are top-connected. The above arrangement also effects a considerable saving in copper.

Each of the three upper floors is designed for a 250-volt storage battery, the lowest of the three floors containing also the high-tension switching apparatus for the incoming feeders from the generating stations and for the high-tension side of the main transformers. The roof is devoted to penthouses containing blowers and to a 6-ton derrick for hoisting battery tanks,

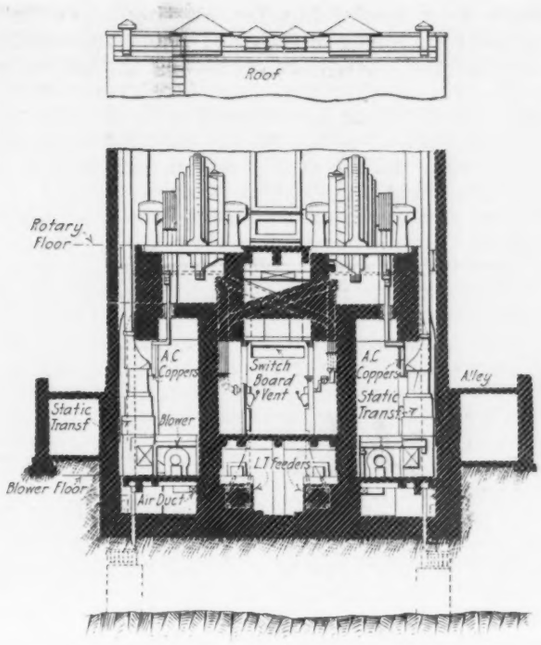


FIG. 3—ARRANGEMENT PERMITTING SHORT CONNECTIONS AND MINIMUM DUCT CONSTRUCTION

switches, etc. A 50-ton crane is installed for handling the rotary converters inside the station, and a removable gantry crane is provided for handling the machines over the sidewalk.

In the sub-basement is installed a 150-gal. sump pump to take care of any accumulation of water. There is also a 500-gal. pump to take care of water which might enter the basement owing to a water main breaking in the streets or to the possible extensive use of water by the Fire Department in extinguishing fires in the immediate neighborhood. The pumps are shown in Fig. 8.

Booster-Type Converters and Diametrically Connected Transformers

The rotary converters, of which four are installed at present, are of the horizontal type, rated at 3500 kw., twenty-five-cycle, 115 r.p.m., six-phase, 270 volts direct current normal. They are separately excited and are of the synchronous-booster type, having a direct-current voltage range from 240 to 310 from no load to 150 per cent load. They are designed with commutating poles containing series and shunt windings, the latter being automatically varied, depending on the load the rotary converter is carrying and also on the amount of voltage, buck or boost, which is being developed by the synchronous booster.

The commutators are slotted, and self-lubricating graphite brushes are used, the brush-holder bracket being locked in a permanent position. Self-lubricating metallized graphite brushes are used on the collector rings. A speed-limit device is provided on each rotary converter which operates both positive and negative circuit-breakers.

The converters are started from the direct-current side by means of a remote-controlled solenoid-operated five-point starting rheostat. The starting connections are such that one starting rheostat is used for all of the converters in the station, with a reserve starting rheostat which may be switched in if desired. Both main-field and synchronous-booster-field rheostats are remote-controlled and motor-operated, and they are designed to make complete travel in forty seconds.

The main transformers for the rotary converters are air-cooled, 3850-kva., 6300-volt, three-phase, to 205-volt, six-phase, units. The high-tension windings are connected in delta and the low-tension windings diametrically. The neutral point is grounded to provide a neutral for the three-wire direct-current system.

A pipe connection is made to the top of the transformer so that in case of fire the unit may be drenched with water. To avoid the accidental wetting of the transformer, a short section of the water-pipe connection is ordinarily left out, this section being so designed that it may be readily inserted when needed.

Feeder Arrangements from Generating Stations

The station design provides for one high-tension feeder for each rotary converter and a loop in and out of a general high-tension feeder, so that under emergency conditions current may be drawn from any of the twenty-five substations. Half of the feeders are brought from the Waterside No. 1 generating station and half from the Waterside No. 2 generating station, so that in case of trouble with either of the above stations only half of the substation feeders will be affected. Care is taken also that the feeders where possible are run by different routes through the streets so that trouble at one point may not affect all the feeders to the substation.

In addition to these precautions to insure absolute continuity of service, the generating stations are connected by high-tension tie feeders to the generating stations of other public utility companies. Each high-tension feeder to the substation consists of a three-conductor 350,000-circ. mil sector-type cable, with 5 5/32-in. paper around each conductor, and over all a 5/32-in. layer of paper and a 1/8-in. lead sheath.

High-Tension Connections

In Fig. 9 typical high-tension connections are shown. Each high-tension feeder is protected by an automatic

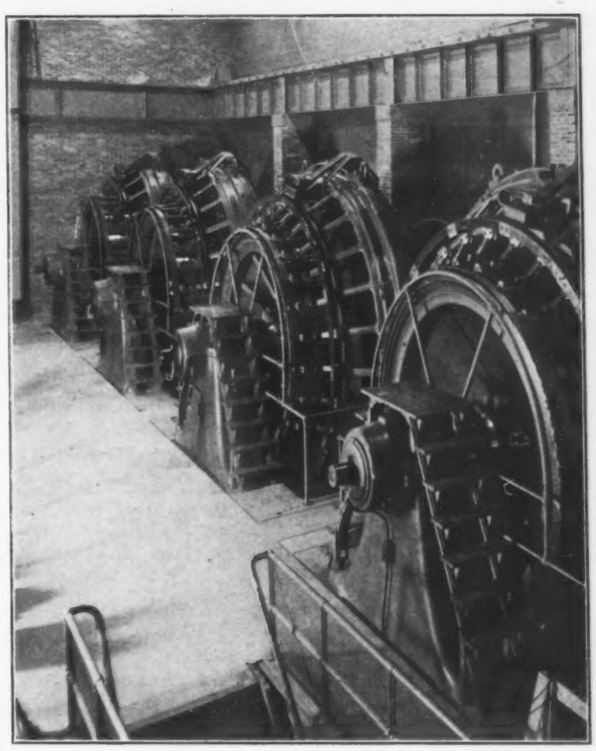


FIG. 4—BOOSTER-TYPE COMMUTATING-POLE CONVERTERS

These machines are cooled by a motor-driven blower installed under the stairway in the foreground, the damper in each branch duct being controlled from the operating floor. Wire guards are attached to the pipe framework shown at the ends of the converters to prevent persons on the ladders or platforms from slipping into the revolving armature.

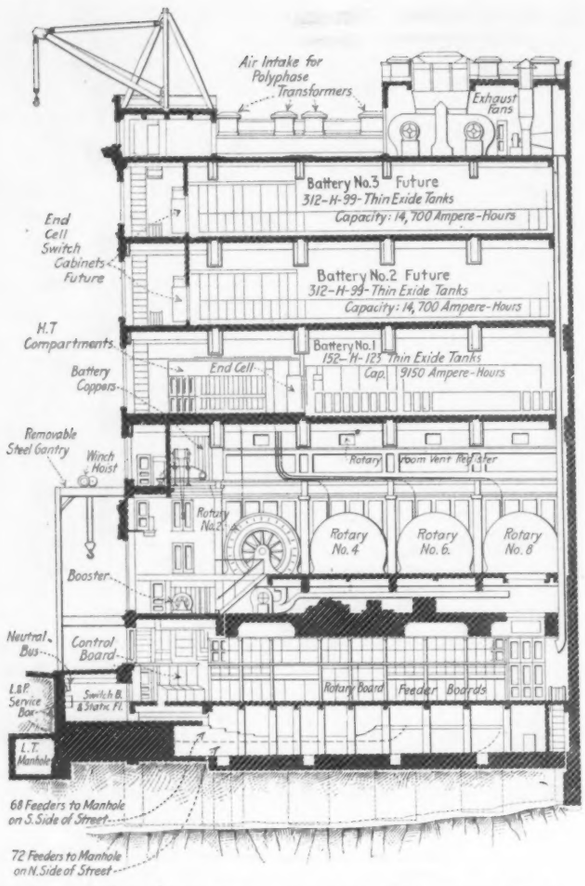


FIG. 5—ARRANGEMENT OF SUBSTATION EQUIPMENT

motor-operated oil switch and may be thrown on either a main or an emergency bus by means of non-automatic solenoid-operated selector oil switches.

The main bus consists of a number of short sections, each containing one high-tension feeder and one transformer for a rotary converter. The emergency bus extends the whole length of the station so that any feeder or the transformer of any rotary converter may be connected to it. Ordinarily the rotary converters are operated on the main bus.

From either the main or the emergency buses the connections are taken for each converter transformer by means of non-automatic solenoid-operated selector oil switches passing through an automatic motor-operated oil switch to the transformer. Inverse-time-element overload relays are used on both the automatic feeder and transformer oil switches.

Direct-Current Connections and Switchboard

The direct-current connections are shown in Fig. 9. Circuit-breakers are provided between the rotary-converter terminals and the switches, so designed as to be tripped by speed-limit devices and by hand but not by overload.

There are three buses, and all switches for rotary converters, feeders, batteries and boosters are so designed that they may be connected to any bus. The positive buses are installed on one side of the station and the negative on the other in order to reduce the chances of short-circuits. The three buses are operated at different potentials, and the feeders are distributed among them in order to obtain suitable voltage at the feeder ends.

The rotary-converter switches have a normal rating of 14,000 amp. An additional blade is provided at the top of the positive switch for connecting the rotary converters to a special bus for starting. The battery switches have a normal rating of 10,000 amp. and have a fourth blade on top for connecting the battery to a special bus for charging. The booster switches also have a fourth blade for connecting the booster to the same bus. The feeder switches have a normal rating of 1000 amp. and are arranged in groups of four, each group occupying only 12 in. in width.

From each direct-current feeder switch is run a 1,000,000-circ. mil single-conductor cable, the positive and negative cable being spliced together into a concentric cable in the station manholes. The concentric feeder then runs through the streets to a manhole and a junction box, where it connects to the mains forming the direct-current network. The concentric feeders contain pressure wires which are used to read the voltage of both sides of the system on a voltmeter in the station, push-button switches being provided on the control switchboard for connecting the voltmeter to any pair of pressure wires.

The pressure wires of some feeders, characteristic of groups of other feeders as to voltage, are connected permanently to voltmeters so as to show at a glance the general voltage conditions at the feeder extremities. The neutral for the three-wire system is obtained from the transformer neutral. The neutral bus is installed in the basement and is connected also to the neutrals of the storage batteries.

Storage-Battery Equipment

All batteries are intended for emergency service only and are designed with thin plates in order to obtain the highest economical discharge rate with the available floor space. The battery on the lowest floor, which is in service at present, consists of 152 cells, each cell containing 123 plates, the positive plates being 14/64 in. and the negative 12/64 in. thick. The one-hour discharge rating is 9150 amp.

The batteries on the two upper floors will each consist of 312 cells, each cell containing ninety-nine plates. Each battery will have a one-hour discharge rating of

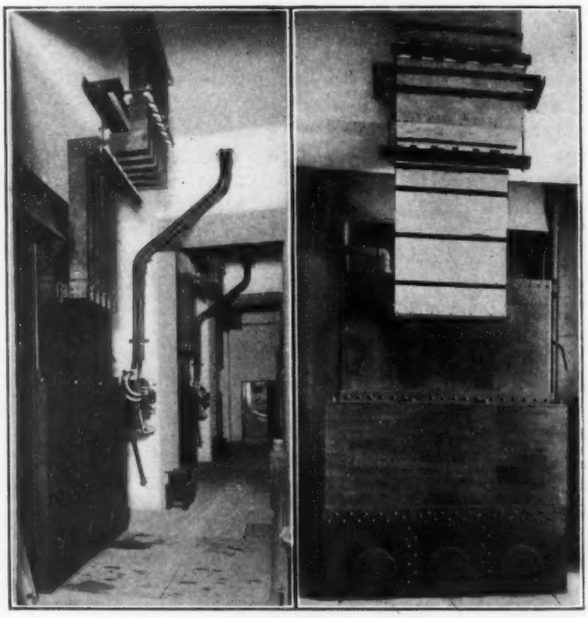


FIG. 6—CONVERTER TRANSFORMER, SHOWING SECONDARY BUSBARS AND INCLOSURE

As the secondary busbars are connected with the slip-rings of the converters directly above the transformers, very little copper and no expensive conduit construction is required. The pipe shown over the transformer on the right is for drenching it in case of fire. The heated air from the transformer room, as well as that from within the units, is drawn up through the hoods over the transformers and discharged at the roof into the atmosphere.

14,700 amp. At the present time 156 cells are installed on the second battery floor. An inspection charge once a week is given the batteries, and a test discharge once every three months.

The curve in Fig. 7 represents the maximum load which the standby storage battery would have to carry under existing conditions in case the normal supply of energy is interrupted. Since the average load is much less than the yearly maximum, the battery will rarely

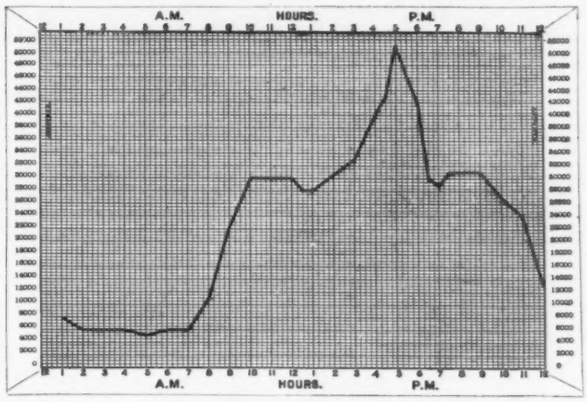


FIG. 7—CHARACTERISTIC MAXIMUM-LOAD CURVE

be called upon to discharge at its maximum rate; therefore the load can ordinarily be carried by the storage battery for the greater share of an hour. This time leaves sufficient leeway to clear interruptions of service.

Two motor-operated, remote-controlled end-cell switches are provided on each polarity of each battery, either of which is capable of carrying the full battery output. The switches are normally operated in parallel. The connections to the end-cell switches are of copper bar supported in porcelain insulators suspended from the ceiling.

For convenience in charging individual cells a special bus is run over all of the cells to which leads may be clamped for connecting it to any cell. Switches are provided for connecting the individual-cell charging bus to the booster.

The booster is a four-bearing set, consisting of a 150-hp. direct-current shunt-wound motor and two 48-kw. generators. Each generator has two commutators which may be thrown either in series or parallel. The fields

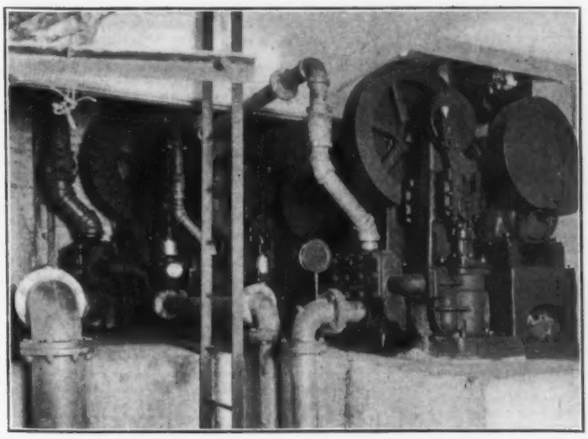


FIG. 8—AUTOMATICALLY CONTROLLED SUMP PUMPS

Ordinarily one of the smaller pumps will dispose of all water which will collect in the sump. To prevent any possibility of flooding, however, a duplicate of the small 150-gal. set and a 500-gal. pump are also provided. These are controlled by Sundh float switches. Another pump of the centrifugal type, but not shown in the illustration, is employed to fill a large storage tank on the roof of the substation from which water is drawn in case of fire.

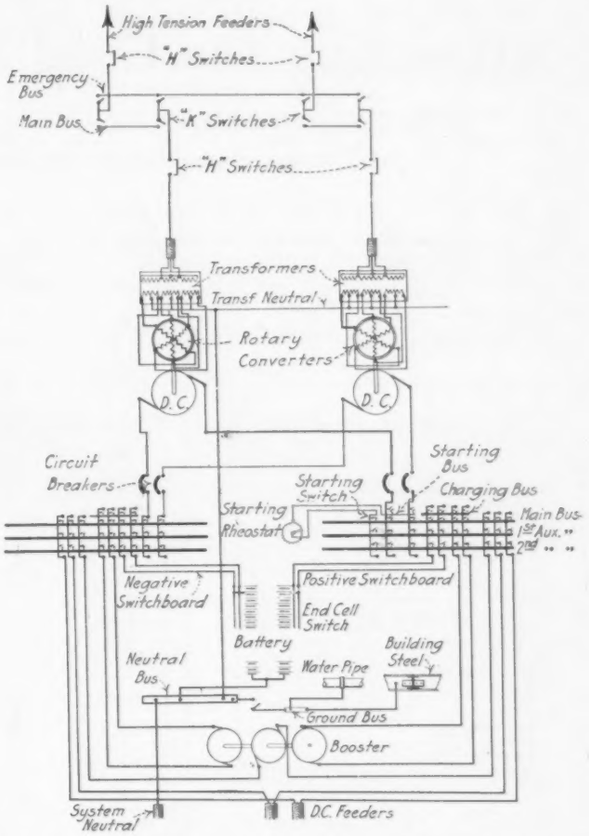


FIG. 9—CONNECTIONS OF ALTERNATING-CURRENT AND DIRECT-CURRENT EQUIPMENT

The connections for only two rotary converters and their corresponding transformers were indicated in this diagram as the connections for the remainder of the equipment are a repetition of those shown. The letters indicating types of switches refer to General Electric equipment. Any converter can be operated from any high-tension feeder, and any direct-current feeder or groups of feeders can be connected with any converter.

are provided with the potentiometer type of rheostats so that the voltage may be varied from zero up. Each generator is designed for 800 amp. at 60 volts or 1600 amp. at 30 volts.

Building and Equipment Ventilation

Each transformer is provided with a blower underneath it driven by an induction motor which is connected to the secondaries of the transformer and starts when it is energized. Fresh air is drawn from the roof. After passing through the transformers the air is drawn up by exhaust fans on the roof and discharged. Provision is also made for blowing fresh air into the transformer room through floor registers, in order to take care of the heat radiated from the outsides of the transformers. The rooms for the rotary converters and the switchboards are ventilated by means of exhaust fans installed in a penthouse on the roof.

Each of the three battery rooms is ventilated by an exhaust fan on the roof. The air before being discharged into the atmosphere is drawn through a special Metropolitan acid-neutralizing device. All of the blowers are of the Sirocco type and are driven by direct-current motors, except in the case of the motors for the transformer blowers.

The acid neutralizers contain vertical alloy-metal screens over which water or an alkaline solution is allowed to trickle. As the air passes through the sheet of water any acid which may be entrained will be absorbed by the water or neutralized by the alkali. The circulation of the washing fluid is maintained by motor-driven centrifugal pumps.

Attracting the Good Will of 2,500,000 People

Public-Utility Advertising Which Is Calculated Figuratively to Lock the Barn Door of Public Opinion Before the Horse of Electric-Service Profit Is Stolen

A SERIES of newspaper advertisements now being published by the Commonwealth Edison Company of Chicago is of rather exceptional interest as an example of the effort to acquaint the public with the central-station point of view. Apparently it is not so much the aim of this advertising to sell energy as to gain increased good will and confidence. The series is, as it is entitled, "A Report to the Public." Its purpose, as told plainly and with a ring of sincerity in the first installment, "is to lay before the general public the company's ideas on such subjects as the modern conception of central-station electric service, the company's

A Report to the Public

No. 1 of a Series of Advertisements on Electric Service in Chicago

Now that we are practically settled in our new headquarters—the Edison Building, Adams and Clark Streets—we have thought that it would be timely, and perhaps helpful to the public and to this company, if we addressed ourselves to the people of Chicago through the medium of a series of newspaper advertisements. Our plan in making these little essays—these brief written "talks," each of which can be read by a busy man in less than two minutes—is to lay before the general public our ideas on such subjects as the modern conception of central-station electric service, our place in this community, the service we should render, and the compensation we are entitled to receive for that service. We purpose to discuss (always briefly) our duty to the public and its duty to us, what we have accomplished and what we ought to accomplish. We shall hope to be simple, direct, straightforward, and we shall say what we have to say without exaggeration. The broad question of electricity supply is of great importance, not only in this city, but everywhere. Every student of men and affairs should be informed in relation to it. We shall avoid mere technicalities in discussing it, but, as we are addressing men and women of intelligence, we shall feel free to use words of more than one syllable if necessary.

Of course, we make no concealment of the fact that we are in the business of supplying electrical energy in Chicago for the purpose of making a proper return to the holders of our securities. We hope to continue paying dividends in the future as we (succeeding the Chicago Edison Company) have done regularly since 1880. We must do so if the capital for necessary extensions is to be attracted. But here's the point: we realize that to continue to attract capital we must have the continued good-will of the people of this city. We have enjoyed this good-will in the past and we expect to do so in the future. Moreover, we recognize the fact that the public is entitled to know all about our business; that we are entitled only to a reasonable profit; that we are engaged in operating a public utility, not merely a private venture. We make many reports to national, state and city authorities. It has occurred to us now to make a report directly to the public—to talk over the central-station electric service of Chicago with the people chiefly interested—and this is what is to be attempted in this series of advertisements.

The second article, "Fisk Street a Mecca," will appear in this paper on Thursday, October 7th.

COMMONWEALTH EDISON COMPANY

Supplying Energy

No. 3 of a Series of Advertisements on Electric Service in Chicago

"The generation of current for light and power is becoming more and more a distinct industry." This statement occurs in the *Summary of the Electrical Industries* for 1912, issued by the United States Bureau of the Census. It follows the hardly less significant declaration by the Census authorities that "The returns for electric railways show a marked diminution in the number of companies which generate their power."

These sentences indicate the change which has been brought about in the economic conception of the function of the central station. We all often speak, in a convenient and familiar way, of the "electric-light company," but a more accurate designation is "electric-service company." The company generates electricity because it is such a convenient agent in supplying energy. You take the energy which we bring to you in usable form and in constant, uninterrupted and almost unlimited supply (that's the "service" part, and perhaps it is even more important than the "electric" part), and you make your lamps glow with it, or you make your motors—desk-fan, street-railway, factory—drive machines, or you utilize it for heating, cooking, battery charging, or other purposes. This supplying of energy on demand constitutes a public utility, and, very properly, it is regulated by the public. We have become specialists in this work. We are licensed by the state to do this community service, and as our pay we are permitted to retain a reasonable profit.

Considering the community as a whole, it seems obvious that the cost of producing and distributing energy can be reduced to the lowest terms if the electric-service company is used to supply electricity for all the purposes for which electrical energy can be used—not merely electric lighting, but the operation of all transportation systems and the turning of all the wheels of industry. This company has been measurably successful in broadening the field of the central station, particularly in the supplying of energy to transportation agencies, and it now furnishes all the energy required by the surface and elevated railways of Chicago. This fact has contributed very materially to the very low average rates which are enjoyed by the consumers of electricity in Chicago. It would be absurd for the city dweller to attempt to provide his own water supply or his own gas-producing apparatus, and it is equally unwise for the individual to attempt to produce his own electrical energy. He should share in the benefits of the community's diversity in demand.

"How Diversity Helps" will be explained in the fourth article of this series, which will appear in this paper on Tuesday, October 19th.

Commonwealth Edison Company

Toeing the Mark

No. 6 of a Series of Advertisements on Electric Service in Chicago

Under the above heading some observations are to be made on the quality of central-station electric service.

One interesting thing about electricity is that it cannot be adulterated. From our raw materials, coal and water, we manufacture a product that is 100 per cent pure. But it is possible to serve electricity in such a way that its usefulness for work may be greatly impaired or altogether lost. And it is absolutely essential that the service be uninterrupted.

Consider what would happen in Chicago if the supply of central-station electricity were shut off for half an hour, or for five minutes. All elevated and surface-railway cars would come to a standstill; lights would go out; factory machinery would stop; elevators would cease running; telephone service would be impaired; linotype machines and newspaper presses would become silent—in fact, the industrial life of the city would receive a staggering blow. But such a disaster is as nearly impossible as anything humanly provided against can be impossible. By thousands of loyal, trained employees; by years of experience; by vast stores of coal; by 9 generating stations and 48 substations; by a most elaborate network of interconnecting cables; by 23 reserve storage batteries in 18 scattered locations; by a load-dispatching system which is at least the equal of any train-dispatching system in exacting thoroughness—by these means, and by other precautions, continuity of service is assured. Electricity is always on tap; and it is with the central-station source of supply that isolated plants arrange for connection in case of breakdown.

But possibly we may fail now and then in considerate, patient and courteous relations with customers. We wish that we could report a 100 per cent result here as in the case of our product. We strive earnestly to reach that goal, but in our hearts we know that we fall something short of it. We are very human. And, to tell the truth, you, at the other end of the wire, are sometimes impatient without cause. Of course, we are public-utility people, and you are those whom we serve. We have a duty toward you—a very explicit and direct duty; but in striving to perform that duty may we not have your help? Most complaints are due to misunderstandings. Help us to avoid misunderstandings. If you think we are at fault in any way, tell us. We want your co-operation to help improve the electric service of this city.

The next advertisement of his series will discuss "Rates for Electricity," and will be printed in this paper on Tuesday, November 9th.

Commonwealth Edison Company

Benefits of Monopoly

No. 5 of a Series of Advertisements on Electric Service in Chicago

Allusion was made in a former article to the doctrine of monopoly in the production and distribution of electrical energy, and we want to say a few additional words on this very important subject. If you were familiar with electric-service conditions in Chicago twenty or twenty-five years ago, you will recall that there were a number of concerns, most of them small, selling electricity from central stations. There are not so many today, although the city is so much larger—practically only the Sanitary District and ourselves and a very few so-called "block" electricity plants. This disappearance of small neighborhood plants is largely the result of our efforts, by purchase, and we think it is one of the most beneficial things that we have done for the city of Chicago as well as for ourselves. We do not pretend to have been actuated by philanthropic motives; our success is bound up with the welfare of this community. We must continue to enjoy the good-will of the people of the city; we must conduct this business on a sound economic basis; or we shall fail, for we are a part of Chicago, and the whole is greater than any of its parts.

Monopoly in electric service is an economic necessity. It enables the utility to make use of the diversity in demand of the various consumers of electrical energy in the community. It cheapens production by massing the generation of electricity in large units. It avoids expensive duplication of conduits, cables and pole lines in streets and alleys. It puts the utility in possession of resources that enable it to employ high-grade men to study out economies in production and distribution, and, perhaps equally important, economies in selling, to get the greatest possible income out of the investment. The resulting economies inure to the benefit of all users of electricity, because a utility monopoly without regulation on behalf of the people should not be permitted, and the regulating body will naturally give the public the benefit of economies, allowing the utility its reasonable rate of return. In the case of this company, price reductions have been voluntary.

In an electric-service sense, we urge that the energy users of this city put all their eggs in one basket and then watch that basket. We learn by experience. The Chicago Edison Company thought once that its role was to sell isolated plants; but we have found that it is our business to make and distribute electricity on a city-wide basis.

"Toeing the Mark" is the title of the next piece in this series, to be printed in this paper on Tuesday, November 2nd.

Commonwealth Edison Company

How Diversity Helps

No. 4 of a Series of Advertisements on Electric Service in Chicago

Fortunately, the electrical requirements of "the butcher, the baker and the candlestick-maker" do not exactly coincide. On this fact is based the utilization of diversity, which is of such great importance in the modern methods of making and selling electrical energy.

It is a characteristic of the generation of electricity that the product cannot be stored economically for purposes of distribution. In that respect the manufacturer of electricity is at a disadvantage when compared with the manufacturer of gas, for gas in large quantities can be stored in holders. However, electric storage batteries are of great usefulness as sources of reserve to insure against interruption of service. As a matter of fact, practically all central-station electricity is generated as required. It follows that there must be provided enough generating plant, transmission cables, substations and distributing circuits to take care of the maximum demand. This maximum demand may be at its high range for only half an hour or less on one day of the year, yet we must provide machinery and apparatus to meet it. The business is one, therefore, that tends toward a large amount of idle investment, and it is of the greatest importance to keep the investment working for as many hours of the day and days of the week as it is possible to do with due regard for safety of operation and permanence of service.

In a city like Chicago there is much diversity in the energy requirements of the various industries, and it is the duty of the electricity-supply company to furnish the energy used by all the consumers of energy—home, factory, store, office, railway, or other users—so that, as the maximum requirements do not fall exactly at the same time, the centralized machinery and equipment may be used to the greatest advantage, thus making possible the lowest rates. Producer and consumers have a common interest in the best economic utilization of the diversity of demand. In considering this subject, it is important to remember that the determining factor in fixing the cost of electric service is more the cost of money than the cost of labor or of coal.

In the language of a recent speaker, "If we are to get the very best possible results, alike for the user of the energy in low prices and for the producer in giving him a fair return on his capital, it is essential that the business of supplying energy be centralized in one large organization for a given area."

The next advertisement in this series will be entitled "Benefits of Monopoly," and will appear in this paper on Tuesday, October 26th.

Commonwealth Edison Company

Fisk Street a Mecca

No. 2 of a Series of Advertisements on Electric Service in Chicago

From the point of view of Americans and Europeans interested professionally or commercially in electricity supply, Chicago is a city of exceptional importance and interest. Here problems of electric service have been and are being worked out in such fashion that Chicago is recognized by electrical men the world over as having attained a position of leadership. That this is so is due in no small degree to the alert open-mindedness, the spirit of progress and adaptability, of the people of this city. But we may say also that the high reputation that Chicago enjoys in the electrical industry is due in large part to the enterprise, the boldness of initiative, the recognition of the economic fundamentals on which this business is based, and the desire to play fair, which this company has exhibited. We are honored to contribute our part to the prestige of this City of Might and Enthusiasm, of which we are all so proud. And we are fain to believe that, if the facts are generally known, our fellow Chicagoans will take some pride in us.

The first central-station plant built by the Chicago Edison Company was erected in the building which is the present 120 West Adams Street. It was put into service in 1888, with 80-kilowatt machines, and shut down six years later as quite out of date. The Harrison Street station was built in 1892, and was one of the celebrated plants of the country in its day, the largest of its original units being of 800 kilowatts. Twenty years later it was relatively too small to be operated economically in comparison with our newer generating stations. Fisk Street station was put into service in 1903. It was the first electric generating station in the world to be equipped exclusively with steam-turbine generating units, and it became famous. Its large turbo-generator units revolutionized the methods of making electricity, and it has been visited by thousands of persons. The original machines at Fisk Street were rated at 5000 kilowatts each. They have been superseded by still more efficient units of 12,000, 20,000 and 25,000 kilowatts each. The Quarry Street station of 1908 has 14,000-kilowatt units, and the Northwest station of 1912 has 20,000-kilowatt units, with one of 30,000 kilowatts which has just been put into service. Generating units were increased in size (from 80 to 30,000 kilowatts) to cheapen cost of production, and the wholesaling of electricity was begun on a large scale about ten years ago. Today, with its 238,941 customers, this company is undoubtedly the largest producer of electricity in the world, with an output in 1914 of 1,114,000,000 kilowatt-hours.

The third advertisement in this series, on "Supplying Energy," will appear in this paper on Thursday, October 14th.

COMMONWEALTH EDISON COMPANY

SIX TYPICAL COMMONWEALTH EDISON ADVERTISEMENTS FROM SERIES NOW BEING PRINTED IN THE DAILY NEWSPAPERS OF CHICAGO TO EXPLAIN THE CENTRAL-STATION VIEWPOINT TO THE PUBLIC

place in the community, the service it should render, and the compensation it is entitled to receive for that service." Just as the company's more technical reports are regularly tendered to national, State and municipal authorities to enlighten them on the company's business, so is this report given the public, the most important of all bodies with which the company has to do, so that the people may know more about the company's business.

At present the series is appearing each week in every daily newspaper printed in English in the city. No doubt the completed series will have more articles than are shown on this page, but the six reproduced herewith are typical of the group.

Steady Increase in Light and Power Operations

August Figures Show Gains of Approximately $2,500,000—Average Monthly Gains Since Beginning of Year, $1,500,000

EARNINGS and output of the electric light and power utilities continue to increase over the mark set for the previous year according to the returns received by the ELECTRICAL WORLD. August operations show an increase of 8 per cent in gross earnings and 11.1 per cent in output over August, 1914. These percentages of growth are the largest that have been registered for more than a year.

Although the percentage of growth over the corresponding months in the previous year was in an earlier month only 2 per cent in income and in another month

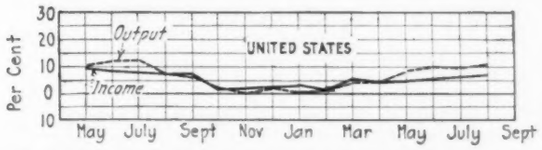


FIG. 1—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

only 0.8 per cent in output, it will be noticed on examining Table I that at no time did either the output or the income of the light and power companies fall below that of the previous year. In all cases there was an increase, and since the first of August, 1914, this increase has amounted to $19,200,000 in gross income, or an average increase of $1,477,000 per month, and an increase in output of 1,016,000,000 kw.-hr., or an average of 77,700,000 kw.-hr. increase per month. With the beginning of the present year, the monthly increases began to grow larger, and for the first eight months of 1915 the average rate of growth of income was $1,540,000 a month and of output 86,400,000 kw.-hr.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

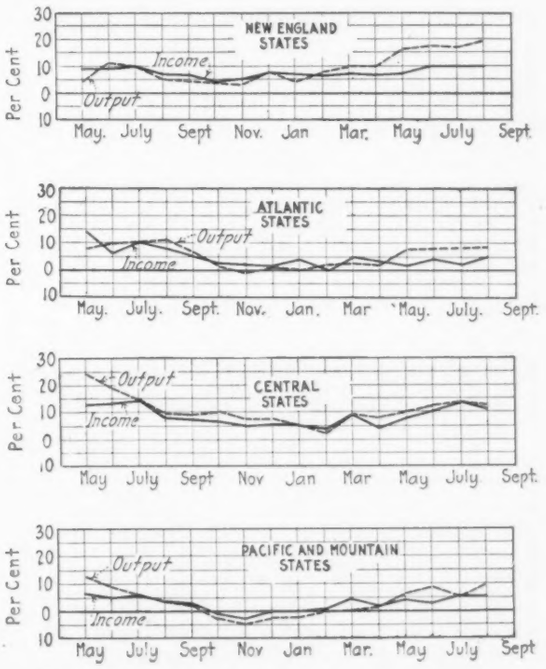
	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
1914							
Sept..	51	$15,708,695	$14,694,205	7.0	782,450,267	733,754,420	6.8
Oct..	59	17,667,912	17,174,567	2.8	969,817,024	935,249,519	3.0
Nov..	65	19,777,650	19,260,451	2.7	986,456,324	978,934,946	0.8
Dec..	65	20,978,430	20,281,812	3.3	1,074,083,543	1,043,457,795	3.0
1915		1915	1914		1915	1914	
Jan..	65	21,582,547	20,697,423	4.1	980,085,036	966,200,323	1.4
Feb..	63	19,395,518	19,023,107	2.0	853,817,221	835,288,039	2.2
Mar..	64	18,654,443	17,529,054	6.4	939,117,179	896,903,968	4.8
April.	65	18,406,412	17,675,784	4.2	900,536,022	859,235,144	4.8
May.	65	17,644,205	16,764,546	5.3	920,895,324	842,386,583	9.3
June.	65	17,595,062	16,469,009	6.9	924,688,923	836,040,113	10.6
July..	64	18,426,038	17,144,735	7.4	965,952,480	875,670,221	10.2
Aug..	63	16,872,881	15,627,336	8.0	897,903,807	807,985,416	11.1

The average rate of growth in income in the first quarter of 1915 was $1,200,000 a month; in the second quarter it was $1,433,000 a month, and in the first two months of the third quarter it was $2,200,000 a month. The growth in August, 1915, reached $2,400,000. The growth in August, 1914, over August, 1913, was $2,100,000.

The average growth in output for the same period follows: First quarter of 1915, 39,000,000 kw.-hr. a month; second quarter, 106,000,000 kw.-hr. a month; first two months in third quarter, 128,000,000 kw.-hr. a month, and in August, 1915, 144,000,000 kw.-hr. The growth in output for August, 1914, over August, 1913, was 115,000,000 kw.-hr.

Average Sectional Increases

A further division of these figures according to the returns received from all sections of the country shows the following average increase: Since the beginning of the war—income: New England States, $213,000 a month; Atlantic, $440,000 a month; Central, $660,000 a month; Pacific and Mountain, $100,000 a month; output: New England, 9,000,000 kw.-hr.; Atlantic, 21,700,000 kw.-hr.; Central, 44,000,000 kw.-hr.; Pacific and Mountain, 5,600,000 kw.-hr. During the first eight months of 1915 the increases in income per month were: New England, $229,000; Atlantic, $415,000; Central,



FIGS. 2 TO 5—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States 1914	New England States 1913	Per Cent Increase	Percentage of Industry Represented	Atlantic States 1914	Atlantic States 1913	Per Cent Increase	Percentage of Industry Represented	Central States (Illinois Excluded) 1914	Central States (Illinois Excluded) 1913	Per Cent Increase	Percentage of Industry Represented	Pacific and Mountain States 1914	Pacific and Mountain States 1913	Per Cent Increase
INCOME	Sept.	61	$1,766,587	$1,647,945	7.3	55	$6,608,221	$6,221,000	6.1	57	$4,704,780	$4,368,251	7.9	75	$2,487,513	$2,398,176	3.7
	Oct.	64	1,963,579	1,889,255	4 0	67	7,451,220	7,232,063	3.1	57	5,105,810	4,783,847	6.8	85	3,146,160	3,157,689	0.3*
	Nov.	67	2,229,742	2,115,957	5.6	69	8,373,772	8,157,966	2.7	57	5,408,672	5,158,981	4 8	88	3,503,499	3,574,086	2.0*
	Dec.	67	2,385,711	2,218,387	7.5	69	8,765,275	8,594,773	2.2	57	5,992,542	5,654,740	5.9	88	3,834,902	3,813,912	0.3
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan.	67	2,423,795	2,271,881	6.8	69	9,075,335	8,695,593	4.4	57	5,827,997	5,525,579	5.4	88	3,960,608	3,917,371	1.0
	Feb.	67	2,246,794	2,134,341	5.4	69	8,037,878	7,968,625	0 9	55	5,296,786	5,148.439	3.0	85	3,576,432	3,534,864	1.2
	March	67	2,146,032	1,999,326	7.5	69	7,777,126	7,419,808	5.2	55	4,885,384	4,465,728	9.5	88	3,605,893	3,412,842	5.8
	April	67	2,109,767	1,976,473	6.8	69	7,510,810	7,241,164	3.9	57	5,003,673	4,773,949	4.8	88	3,475,740	3,366,830	3.2
	May	67	2,035,680	1,887,606	7.9	69	7,100,334	6,912,581	2.6	57	4,946,907	4,577,818	8.1	88	3,383,749	3,233,989	4.8
	June	67	2,063,423	1,874,575	10.2	69	6,945,986	6,628,523	4.8	57	4,984,858	4,485,165	11.2	88	3,409,738	3,281,696	3.9
	July	60	1,966,571	1,787,815	10.0	68	6,710,217	6,519,442	2.9	56	4,792,886	4,203,702	13.9	88	3,539,168	3,317,713	6.8
	August	57	1,948,454	1,761,212	10.6	68	6,853,118	6,511,307	5.3	56	4,741,123	4,232,927	12.2	88	3,192,279	2,993,495	6.7
KW.-HR. OUTPUT	Sept.	61	55,525,272	53,267,877	4.3	55	270,974,533	252,648,550	7.3	57	260,705,339	237,832,934	9.7	75	190,979,705	185,090,658	3.2
	Oct.	64	67,520,070	65,068,938	3.8	67	358,458,539	351,362,247	2.1	57	295,490,712	266,827,567	10.5	85	245,966,868	252,047,828	2.4*
	Nov.	67	69,480,163	66,988,456	3.8	69	361,364,405	364,155,759	0.7*	57	290,681,750	269,220,528	8.0	88	255,651,947	269,467,354	5.1*
	Dec.	67	78,510,793	71,990,132	7.8	69	401,623,514	396,251,867	1.2	57	315,027,232	291,511,670	8.0	88	278,922,004	283,704,076	1.6*
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan.	67	72,550,608	69,317,803	4.7	69	374,972,536	373,336,906	0.7	57	272,623,760	258,572,903	5.5	88	252,531,483	256.198,272	1.4*
	Feb.	67	66,600,132	61,515,979	8.3	69	312,443,505	305,307,260	2.4	55	238,938,034	232,520,476	2.7	85	229,865,568	229.185,967	0.3
	March	67	72,121,319	65,343,335	10.5	69	346,341,496	335,506,429	3.3	55	257,136,231	235,656,647	9.2	88	255,529,704	253,423,951	1 0
	April	67	68,475,232	62,442,110	9.7	69	320,142,323	311,476,008	3.0	57	257,967,434	237,673,326	8.5	88	246,287,781	239,661,364	2.8
	May	67	68,823,914	61,060,621	12.9	69	326,191,569	301,440,779	8.1	57	262,885,043	236,154,464	11.2	88	254,586,394	236,082,868	7.8
	June	67	71,566,127	60,972,379	17.4	69	318,245,370	293,751,083	8.5	57	265,551,926	234,034,477	13.2	88	261,083,835	237,843,021	9.8
	July	60	65,625,675	56,052,473	17.1	68	320,371,761	293,909,832	9.0	56	264,151,924	232,146,227	13.9	88	274,488,334	258,475,004	6.3
	August	57	63,720,346	53,610,119	19.0	68	329,947,721	302,960,234	8.9	56	269,326,039	237,550,530	13.4	88	231,414,480	210,771,797	9.8

*Decrease.

$720,000; Pacific and Mountain, $140,000. Output increases were: New England, 10,400,000 kw.-hr.; Atlantic, 24,500,000 kw.-hr.; Central, 41,000,000 kw.-hr.; Pacific and Mountain, 12,000,000 kw.-hr. The increases of August, 1915, were: Income—New England, $330,000; Atlantic, $560,000; Central, $910,000; Pacific and Mountain, $230,000; output—New England, 18,800,000 kw-hr.; Atlantic, 40,000,000 kw.-hr.; Central, 57,000,000 kw.-hr.; Pacific and Mountain, 23,000,000 kw.-hr.

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED ACCORDING TO SIZE

	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.
INCOME:									
Group 1....	0.6	2.7	2.0	8.0	3.8	4.8	6.5	5.3	7.2
Group 2....	0.9	8.8	3.7	6.9	5.0	6.2	2.8	8.8	9.1
Group 3....	3.3	2.4	2.5	5.2	5.5	5.8	10.1	9.6	12.7
Group 4....	4.8	5.8	6.8	5.0	3.9	7.1	6.9	8.4	8.0
Group 5....	3.2	4.5	0.9	1.6*	1.9	5.5	4.7	6.7	5.5
OUTPUT:									
Group 1....	3.1	3.9	2.8	5.7	5.4	7.2	10.1	11.1	9.7
Group 2....	3.0	4.3	5.7	7.9	11.2	13.1	9.1	18.1	19.0
Group 3....	6.8	1.2	3.9*	3.6*	1.2*	6.1	11.2	4.5	10.8
Group 4....	9.2	9.0	5.5	3.2	3.0	29.1	6.0	12.1	10.5
Group 5....	1.8	7.5	15.0	7.0	5.9	15.5	14.8	22.8	13.8

*Decrease.

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.
INCOME:									
Group 1....	7.9	7.1	5.7	6.6	6.3	9.4	11.6	11.2	11.0
Group 2....	5.5	6.2	4.1	9.0	4.04	7.5	7.0	9.1	9.6
Group 3....	11.4	7.5	0.7	7.8	20.6	8.9	21.8	9.1	13.6
Group 4....	8.2	8.9	9.4	6.5	8.4	7.1	11.9	7.5	8.4
Group 5....	5.5	2.1*	1.9	14.7*	0.4*	1.0*	2.8	11.6	16.5
OUTPUT:									
Group 1....	12.5	6.3	11.1	12.0	12.7	16.0	19.0	16.7	17.2
Group 2....	5.9	5.4	6.4	12.3	12.3	19.9	20.8	27.0	26.0
Group 3....	11.0	1.2	3.6*	0.3*	3.2	7.0	17.9	17.0	22.3
Group 4....	12.5	10.9*	9.4	12.5	12.1	6.3	17.1	17.0	11.0
Group 5....	4.1	9.0*	6.1	29.8*	25.5*	13.5*	1.0	12.7	26.0

*Decrease.

War Orders Cause Increase

The reports from the different companies indicate that the large increases are due mostly to an expansion in the industrial motor-service load. Companies operating in New England state that war orders have created a large demand for additional motor equipment. This source of business, it is claimed, is largely responsible for the substantial and profitable increases in business in that territory. The reports from the Texas region which was devastated by the August storm show a falling off. In the zinc-mining belt new and increased operations have called for more and larger motors. Several companies in the central portion of the country have had their plants pushed to the limit by this load.

The resumption of the iron and steel business in order to take care of the fast-growing demand made by makers of munitions of war has added materially to the business of the electric utilities. The general business depression in the far Northwest has been responsible for a decreased output in that section. In California the Exposition and energy for irrigation and for gold mining have called for certain increases. So numerous indeed are the individual factors which govern these percentages that space will not permit of a

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED ACCORDING TO SIZE

	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.
INCOME:									
Group 1....	1.6	1.3	1.3	4.7	1.6	2.0	3.8	1.4	4.0
Group 2....	3.9	5.0	4.2	7.1	5.6	8.2	8.0	9.7	11.6
Group 3....	0.4	3.3	3.6	3.8	4.1	1.6	7.5	7.5	8.5
Group 4....	7.9	4.9	10.1	6.8	2.9	6.2	3.9	7.0	8.4
Group 5....	11.2	9.0	†	†	15.2	19.6	14.8	†	2.0*
OUTPUT:									
Group 1....	3.2	1.7	3.0	6.1	4.8	9.0	8.2	8.0	9.0
Group 2....	4.3	3.1	7.0	9.7	7.6	7.1	11.0	17.0	15.0
Group 3....	7.7*	7.4	2.7*	8.5*	4.1*	3.2	7.2	7.5	6.4
Group 4....	6.2	7.8	6.3	10.2	1.9	22.5	7.1	13.8	13.2
Group 5....	11.1	13.5	†	†	57.2	71.5	61.8	†	11.4

*Decrease †Results omitted owing to insufficient returns.

further enumeration; but it is safe to say that the increases are not larger principally for two reasons: (1) the decreasing specific consumption of incandescent lamps, and (2) decreases in rates. With the exception of cities having a population between 5000 and 10,000 the reports for August show generally larger increases than for previous months.

It will be noted from a survey of the accompanying graphs that the percentages of growth are fast approaching those that existed before the war. The general tendency, it will be noted, has been for a larger and larger growth. The growth in New England, as the curve shows, has been abnormal, but, as the companies report, this is explained by the increased demands for energy due to war orders. In the other sections of the country the curves reflect industrial conditions.

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED ACCORDING TO SIZE

	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.
INCOME:									
Group 1....	5.2	6.1	3.5	10.1	7.3	9.8	11.4	11.8	12.2
Group 2....	7.5	4.3	1.4	5.9	3.5	3.0	5.6	7.0	7.5
Group 3....	7.5	2.1	6.2	11.3	10.4	15.5	19.6	16.4	21.0
Group 4....	6.4	3.6	6.0	8.3	6.0	6.7	12.4	13.0	16.9
Group 5....	1.5*	3.7	2.8	7.7	7.6	19.9	5.0	1.2	20.2
OUTPUT:									
Group 1....	4.2	9.0	4.7	7.7	6.8	8.4	10.8	11.8	12.2
Group 2....	12.4	4.8	1.2	8.0	12.5	9.7	13.5	11.1	9.8
Group 3....	12.4	8.2	6.2	14.7	13.1	27.0	26.1	28.9	31.0
Group 4....	13.3	8.4	10.0	12 8	7.9	10.0	15.7	18.2	26.1
Group 5....	13.0	13.7	18.3	13.5	39.7	28.8	20.4	24.9	25.1

*Decrease.

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Dec.	Jan.	Feb.	March	April	May	June	July	Aug
INCOME:									
Group 1....	0.6*	1.0*	0.4	8.1	4.0	3.1	9.0	5.1	7.0
Group 2....	1.0	4.9	8.0	7.5	9.4	12.7	11.1	13.0	11.1
Group 3....	1.0	0.6	2.6*	1.0*	0.3*	3.4	3.6	7.9	8.3
Group 4....	6.5	6.2	0.6	2.6*	3.8*	8.7	1.6*	7.8	0.2
Group 5....	2.5*	1.8	2.0*	3.5*	2.7*	2.4*	3.3	4.5	1.7*
OUTPUT:									
Group 1....	0.0	1.5	0.5*	2.5	4.5	2.3	10.8	6.2	6.3
Group 2....	13.0*	7.2*	13.5	3.0	11.6	19.0	14.9	27.5	39.3
Group 3....	14.2*	13.5*	11.5*	4.0*	3.5*	3.8	12.4	8.4*	8.6
Group 4....	3.7	9.5	0.6*	9.5*	4.7*	87.0	4.5*	11.8	0.2
Group 5....	1.0	4.1	9.9	18.0	9.6	18.5	3.6	10.9	8.0

*Decrease

These curves are the graphic representation of the percentage increases contained in Tables I and II. The remaining tables show the percentage increases both in income and output for cities grouped according to size. Group No. 1 includes cities whose population is over 100,000; group 2, those cities having a population between 50,000 and 100,000; group 3, those having between 25,000 and 50,000; group 4, those between 10,000 and 25,000; group 5, those between 5000 and 10,000.

Parallel vs. Staggered Arrangement of Lamps

An Investigation of the Relative Merits of the Two Systems of Installing Ornamental Street-Lighting Standards

BY H. E. BUTLER

THE two customary methods of installing ornamental street-lighting standards along two sides of a street are the parallel and the staggered arrangement. With the former plan the lamp standards on the two sides of the roadway are directly opposite each other. In the case of the staggered arrangement the lamps on one side are placed midway between the positions occupied by the lamps on the other side of the street. It is often a perplexing problem to determine which method is preferable.

Objectionable Distribution Condition

From an ornamental standpoint, the parallel arrangement seems to have the advantage as it presents a symmetrical vista and is, therefore, more pleasing. On the other hand, if the longitudinal spacing is in excess of the width of the street, an objectionable distribution is likely to occur; that is, the illumination along the street and building façades will be spotted or non-uniform. To correct this condition it is frequently necessary to stagger the units.

The results of a study of the merits of these two arrangements are given in the accompanying tables and curves. These data are based on the use of 5-amp. General Electric direct-current series ornamental luminous-arc lamps. The lamps are assumed to be equipped with high-efficiency electrodes and with diffusing glass globes of medium density.

Briefly stated, a study of the accompanying charts shows the following: First, that from an ornamental standpoint the parallel arrangement is preferable; second, for any specific width of street and spacing more uniform illumination is obtained from staggered units; third, parallel systems are preferable where the ratio

ORNAMENTAL LIGHTING OF A BUSINESS THOROUGHFARE WITH ARC STANDARDS

Spacing	Watts per Linear Ft.	Average Ft.-Candles			Maximum Ft. Candles			Minimum Ft. Candles			Min. Ft.-Candles / Max. Ft.-Candles		
		Width of Street			Width of Street			Width of Street			Width of Street		
		40 Ft.	60 Ft.	80 Ft.	40 Ft.	60 Ft.	80 Ft.	40 Ft.	60 Ft.	80 Ft.	40 Ft.	60 Ft.	80 Ft.
80 Ft. Apart	10.1	.865	.509	.308	.150	.708	.376	.480	.389	.255	.320	.550	.678
100 " "	8.06	.690	.411	.244	.145	.665	.341	.295	.238	.182	.204	.358	.534
120 " "	6.72	.576	.340	.204	.143	.648	.326	.198	.155	.127	.138	.239	.389
150 " "	5.37	.472	.275	.165	.141	.632	.312	.104	.092	.078	.074	.146	.250
200 " "	4.03	.345	.204	.122	.141	.625	.305	.044	.040	.036	.031	.064	.118
250 " "	3.23	.283	.165	.099	.140	.622	.302	.022	.021	.020	.016	.034	.066

TABLE I—ILLUMINATION VALUES ALONG CENTER LINE OF STREET SURFACE WITH PARALLEL ARRANGEMENT OF LAMP STANDARDS

Spacing	Watts per Linear Ft.	Average Ft.-Candles			Maximum Ft.-Candles			Minimum Ft.-Candles			Min. Ft.-Candles / Max. Ft.-Candles		
		Width of Street			Width of Street			Width of Street			Width of Street		
		40 Ft.	60 Ft.	80 Ft.	40 Ft.	60 Ft.	80 Ft.	40 Ft.	60 Ft.	80 Ft.	40 Ft.	60 Ft.	80 Ft.
80 Ft. Apart	10.1	.865	.509	.308	.988	.549	.327	.796	.497	.294	.806	.888	.900
100 " "	8.06	.690	.411	.244	.872	.452	.261	.599	.380	.233	.688	.841	.893
120 " "	6.72	.576	.340	.204	.808	.401	.227	.434	.301	.190	.538	.751	.837
150 " "	5.37	.472	.275	.165	.759	.362	.195	.283	.221	.144	.373	.610	.739
200 " "	4.03	.345	.204	.122	.715	.333	.172	.149	.120	.092	.206	.361	.535
250 " "	3.23	.283	.165	.099	.712	.321	.161	.083	.071	.058	.117	.221	.360

TABLE II—ILLUMINATION VALUES ALONG CENTER LINE OF STREET SURFACE WITH STAGGERED ARRANGEMENT OF LAMP STANDARDS

of street width to lamp spacing approaches unity, staggered arrangements are preferable where ratio of street width to spacing is great.

Figs. 1 to 3 show the distribution of illumination along the center line of streets having widths of 40 ft., 60 ft. and 80 ft. The full-line curves refer to parallel arrangements of lamp standards and the dotted curves

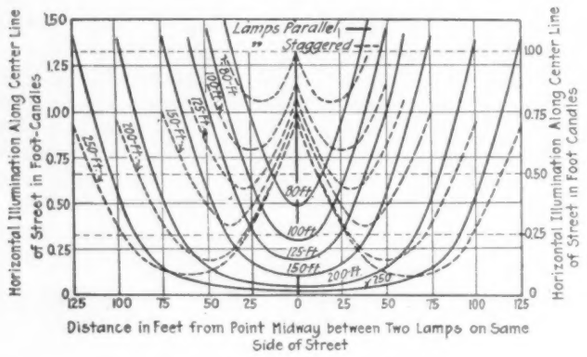

Lamps Parallel
" Staggered
Horizontal Illumination Along Center Line of Street in Foot-Candles
Horizontal Illumination Along Center Line of Street in Foot Candles
80 Ft.
100 Ft.
125 Ft.
150 Ft.
200 Ft.
250
Distance in Feet from Point Midway between Two Lamps on Same Side of Street

FIG. 1—HORIZONTAL ILLUMINATION ALONG CENTER LINE OF STREET 40 FT. WIDE WITH PARALLEL AND STAGGERED ARRANGEMENTS OF LAMP AND WITH DIFFERENT LAMP SPACINGS

to staggered arrangements of lamp standards. In every case the distance between lamp standards on the same side of the street is indicated on the corresponding curve.

In Tables I and II will be found the data from which these curves were plotted. Figures showing the maximum and minimum intensities of illumination along

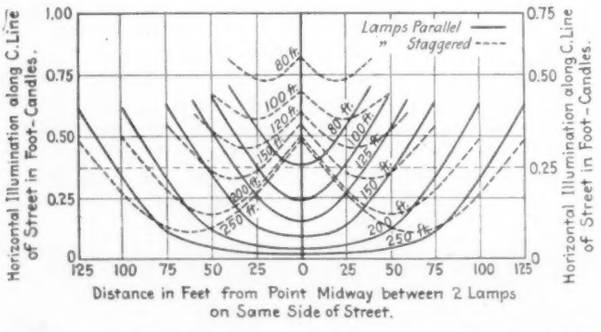

Lamps Parallel
" Staggered
Horizontal Illumination along C. Line of Street in Foot-Candles.
Horizontal Illumination along C. Line of Street in Foot-Candles.
80 Ft.
100 Ft.
120 Ft.
150 Ft.
200 Ft.
250 Ft.
Distance in Feet from Point Midway between 2 Lamps on Same Side of Street.

FIG. 2—HORIZONTAL ILLUMINATION ALONG CENTER LINE OF STREET 60 FT. WIDE WITH PARALLEL AND STAGGERED ARRANGEMENTS OF LAMPS AND WITH DIFFERENT LAMP SPACINGS

the center line of the street surfaces are given for each case.

In Fig. 4 the ratios of the minimum to the maximum illumination along the center lines of streets of three widths are plotted as a function of the watts per linear foot. By watts per linear foot is meant the quotient of the rating of the lamp used expressed in watts, divided by the distance in feet between two standards on the same side of the street. Here, as in the case of the previous curves, the full-line curves refer to parallel arrangements of lamps and the dotted curves to staggered arrangements.

Although a parallel arrangement of standards may be preferable from the ornamental or esthetic point of view, the data herewith published show that for any

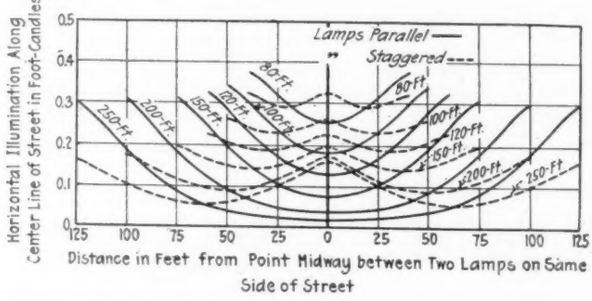


FIG. 3—HORIZONTAL ILLUMINATION ALONG CENTER LINE OF STREET 80 FT. WIDE WITH PARALLEL AND STAGGERED ARRANGEMENTS OF LAMPS AND WITH DIFFERENT LAMP SPACINGS

specific width of street and any specific lamp spacing more uniform illumination is obtained with staggered units. Parallel systems, however, appear to be preferable where the street width is not much greater than the distance between lamp standards. Where the ratio of street width to lamp spacing is great, staggered arrangements are preferable.

In applying these data the importance of local influences should not be minimized. For example, a street bordered with trees requires a different treatment from one that is free of trees. In all cases the

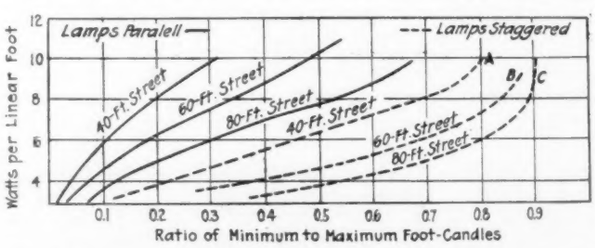


FIG. 4—RATIO OF MAXIMUM HORIZONTAL ILLUMINATION ALONG CENTER LINE OF STREET AS A FUNCTION OF WATTS PER LINEAR FOOT WHERE STREET WIDTHS ARE 40 FT., 60 FT. AND 80 FT.

correct design from an engineering standpoint depends largely upon a careful study of all local conditions. Often esthetic principles must have greater weight than utilitarian principles. In other cases the reverse is true, while a compromise must be made in a great number of cases.

Station and Operating Practice

A Department Devoted to the Problems of Installation, Operation and Maintenance of Equipment for the Economical Generation and Distribution of Electrical Energy for All Uses.

Results of Diesel-Engine Operation at Hutchinson, Minn.

BY THOMAS PITTS*

When it was finally decided to enlarge the Hutchinson (Minn.) generating station of the Northwest Light & Power Company, the installation of a condensing steam turbine was favorably considered on account of the development of a fairly good twenty-four-hour load-factor and also because of the fact that an abundance of water was available for condensing purposes. The merits of a Diesel-engine installation were also considered at the same time, with the result that a triple-cylinder 225 b.-hp. equipment directly connected to a 160-kw. General Electric generator operating at a speed of 164 r.p.m. was purchased. The selection was based on fuel economy for this type of prime mover and the fact that it was possible to install the engine, generator, exciter and other equipment in a space 12 ft. by 30 ft. which had been reserved for the installation of another boiler in the steam plant. The fuel-oil tank required, of 12,000 gal. capacity, was placed in the yard about 30 ft. from the engine, and a pipe line was laid to the tracks of the Great Northern Railway Company about 800 ft. distant, where a small electrically operated pump was placed. This arrangement permitted fuel to be unloaded from the car tracks and delivered to the storage tank by connecting the car to the pump.

The fuel account during the first six months of operating the Diesel engine was reduced 61 per cent below the corresponding period of the previous year, when steam equipment was operated. This reduction was effected although the electrical output during this period was 15 per cent greater. The consumption of fuel oil since February, 1915, has been approximately 1 gal. for each 8 kw.-hr. generated, with a load-factor of about 30 per cent. A representative daily load curve and fuel consumption curve are shown in Fig. 2. Comparative operating costs for steam and Diesel-engine operation on June 12, 1914 and 1915, are given in the accompanying table.

*Manager Northwest Light & Power Company, Hutchinson, Minn.

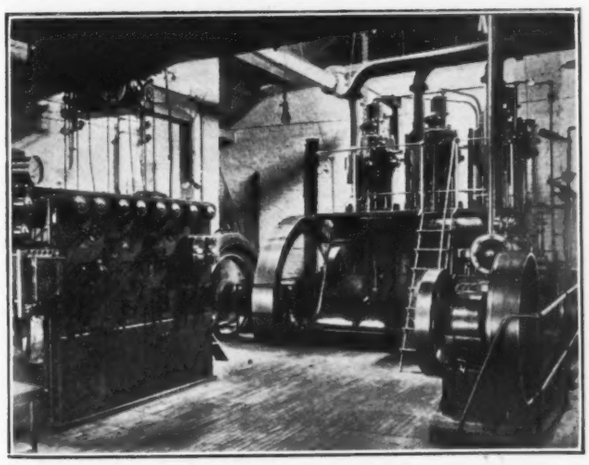


FIG. 1—DIESEL-ENGINE INSTALLATION IN HUTCHINSON STATION OF NORTHWEST LIGHT & POWER COMPANY

The plant has been in continuous operation for the past eight months, twenty-four hours per day and seven days per week, except for a weekly shut-down from 2 p. m. to 5 p. m. on Sundays for inspection, adjustment and general looking over, which includes adjustment of bearings, cleaning crank case and inspection of water-cooling chambers.

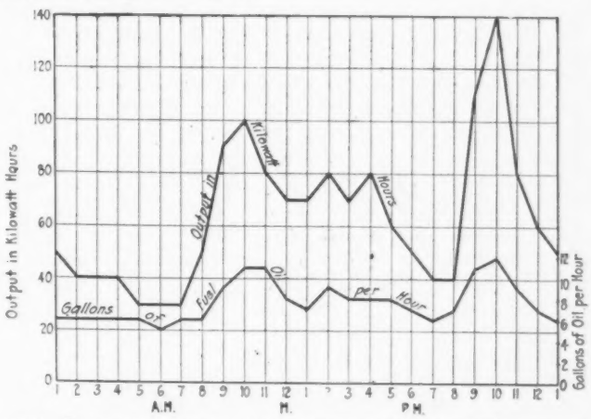


FIG. 2—LOAD CURVE AND FUEL CONSUMPTION FOR A 160-KW. DIESEL-ENGINE PLANT

It has been found that a man of ordinary operating ability can handle the equipment satisfactorily when instructed as to the manner and time of lubrication, the adjustment of injection air pressure for varying loads, and the method of stopping the engine in case of an emergency. The operators, however, should be good mechanics, capable of making adjustments accurately. Two operators are required for the Hutchinson station.

DAILY OPERATING COSTS FOR STEAM AND DIESEL-ENGINE EQUIPMENT AT HUTCHINSON, MINN.

	Steam-Plant Operation, June 12, 1914	Diesel-Plant Operation, June 12, 1915
Output, kw.-hr.....	1058.0	1520.0
Cost of coal or oil.....	$18.30	$6.40
Lubricating oil.....	0.22	0.90
Attendance.....	5.20	4.30
	$23.72	$11.60

Inexpensive Way of Stopping Leaks in Boiler Settings

BY J. R. CRAVATH

Excess air in stack gases, which is manifested by a low percentage of CO_2, lowers both the efficiency and the steaming capacity. The efficiency is lowered because of the heating of unnecessary air that leaks through the walls of the furnace and carries away heat which otherwise would be transferred to the boiler. The steaming capacity is reduced because of the reduction in effective draft by such air seepage, as well as by the loss of heat. Attention has been called from time to time to the importance of carefully going over the boiler setting

and stopping up all cracks, especially those likely to go unnoticed where brick and iron come together. Piecemeal stopping of cracks and crevices, however, stops only part of the avoidable air seepage into the furnace. There is a method which is less expensive in the long run because it requires less attention and not only stops the various visible cracks and crevices but also the large seepage which takes place through very small holes and pores in the brick. One method is to cover the whole setting with something that is not porous, as a steel jacket. This is rather expensive in first cost, troublesome to remove and replace when repairs are necessary, and hardly suitable to small boiler plants where covering is most needed. The most satisfactory method, according to the writer's experience, is to cover the brickwork and joints of the setting with heavy cotton sheeting or very light canvas, the former being preferable. The sheeting may be applied like wallpaper with rye-flour paste. After it has been applied a suitable filling will prevent the air seepage. This filling can be done either with the paste or with an application of water glass (sodium silicate) as a paint. This stops up the cracks and pores by the wholesale and does it cheaply and effectually. The cost of this covering is so small that its destruction to make boiler setting repairs is a small matter. Although the stopping of air seepage into the setting is one of the first and most important steps in securing boiler efficiency, it is by no means the only step, and must be considered along with a number of other operating precautions if substantial improvements in economy are to be made.

After such a covering is put over the brickwork of a boiler setting it will likely be found that the brickwork feels warmer to the hand than before. While this may indicate on first thought an increased radiation loss, it is in reality the best evidence possible that the covering is doing the work for which it was intended. The seepage of air through the brickwork no longer cools it, and consequently the heat which was formerly carried along with the inflowing air into the furnace and up the chimney is now conducted through the brickwork and radiated from the covering. However, these radiation leaks are not serious, and the losses caused by them are small compared with the losses caused by the infiltration of air. A lagging of the boiler setting to stop radiation losses has been suggested and used, and it is probable that the gain in economy and capacity resulting upon the stoppage of air infiltration by such a lagging is more important in dollars and cents than the stopping of radiation losses from the settings.

A Formula for Checking Operating Temperature of Water-Cooled Transformers

BY G. E. ARMSTRONG

Those in charge of the operation of power transformers, especially transformers of the water-cooled type, frequently find that the temperature is above that to which they have been accustomed. At such times the operator may be at a loss to determine the reason for the unusual temperature. The kva. load is the first consideration, to be sure that the higher temperature is not due to an excess load. If conditions are normal, the next thing will be to determine whether or not there is a proper flow of cooling water. Even with readings of the temperature of the cooling water and figures showing its rate of flow, the operator may still be puzzled. To assist in such cases, and to follow the operating history of transformers and so be informed when scale is forming in the cooling coils, the following formula of the rate of heat transference has been found by the writer to be of practical value: U is the rate of heat transference; T, the temperature of oil in top part of transformer; T_1, the temperature of ingoing water; T_2, the temperature of outlet water; W, the weight of cooling water in pounds per hour, and A, the internal area of cooling coils in square feet. A may be conveniently obtained from the transformer specifications. All temperatures are in degrees Fahrenheit. Then

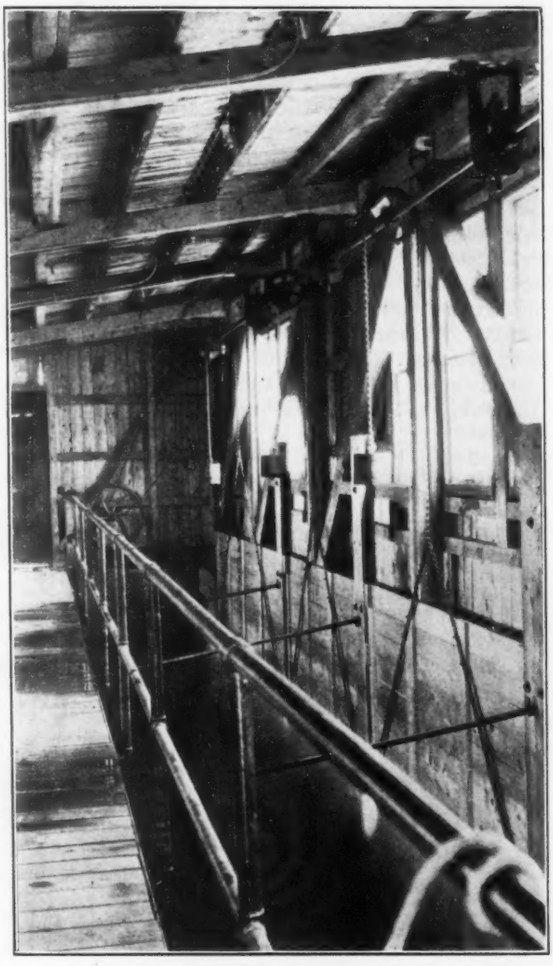
$$U = \frac{W(T_2 - T_1)}{A\left(T - \frac{T_2 + T_1}{2}\right)}.$$

The values of U have been found to range from 20.0 for a new clean transformer down to a value of only 8.0 for a transformer whose coils are clogged with scale.

Successive calculations of the changing values of U are of interest when the scale is being flushed out with acid, since by this means one may determine the progress of the action.

Use of Special Gates to Prevent Ice Formation at Intake Screens

At the Dundee Falls (Me.) hydroelectric plant of the Presumpscott Electric Company trouble due to ice in the forebay was effectively prevented last winter by the installation of gates just outside the screens at the penstock intakes, as shown in the accompanying illustration. The gates are placed in a house about 60 ft. long by 6 ft. wide and raised and lowered by sprocket chains running on wheels mounted on a horizontal line



HAND-OPERATED SCREENS TO PREVENT ICE FORMATION AT PENSTOCK INTAKES

shaft extending the entire length of the gatehouse. At the further end of the house a hand wheel with sprocket and chain connection controls the shaft, so that one man can raise or lower the gates with ease. The gates are balanced by counterweights of about 30 lb. The line shaft is divided into three sections, with flanged couplings at each section end, and as the gates fit loosely into grooves in the sides of the stanchions, no trouble from friction has been encountered. Five gates are installed, each being about 5 ft. by 10 ft. in dimensions and built of 1-in. sheathing. On the approach of a cold snap last winter the gates were lowered a little below the surface of the water and effectively cut off ice formation from the screens on the inside of the gatehouse.

Observations on Effect of Preservatives on Wood Poles

At the recent St. Louis convention of the American Institute of Electrical Engineers F. L. Rhodes and R. F. Hosford presented an exhaustive report on the effect of preservatives on wood poles, giving data on the increase in life obtained with treated poles and stating the conditions that limit the effectiveness of the preservative.

Among deductions made from observations of poles treated throughout their entire length, the following are significant: The principal cause of deterioration in the top section appeared to be the cutting off of the top, hence all timber should be completely framed before treatment. Bleached and other light-colored poles yielded a percentage of decayed specimen considerably above the average for all poles inspected. As the lighter-colored poles are presumably those which retain the lesser amounts of preservative, it follows that the life will increase with the amount of preservative applied. Poles which were erected at high altitudes showed more than the normal amount of decay, while the lowest proportion of decayed poles were erected in muck. On one line 50 per cent of the poles showing no tar on the exterior were decayed, as against 39 per cent decayed for poles showing streaks of tar near the ground line and 18 per cent decayed for poles streaked with tar throughout their length. The data from this line of test poles show that the conditions to which the top of the pole is exposed favor a more rapid removal of the volatile constituents of the preservative than occurs in the butt section. The poles suffered losses in the proportion of the low-boiling constituents in the preservative, the data indicating that no appreciable loss by evaporation occurs in the case of constituents of the oil distilling above 270 deg. C.

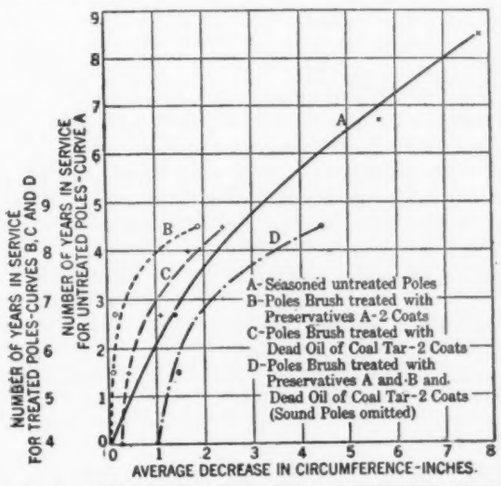

NUMBER OF YEARS IN SERVICE FOR TREATED POLES-CURVES B, C AND D
NUMBER OF YEARS IN SERVICE FOR UNTREATED POLES-CURVE A
AVERAGE DECREASE IN CIRCUMFERENCE-INCHES
A
B
C
D
A-Seasoned untreated Poles
B-Poles Brush treated with Preservatives A-2 Coats
C-Poles Brush treated with Dead Oil of Coal Tar-2 Coats
D-Poles Brush treated with Preservatives A and B and Dead Oil of Coal Tar-2 Coats (Sound Poles omitted)

FIG. 1—EFFECT OF TREATING CHESTNUT POLES

Many of the poles showing decay were observed to have exposed heartwood and checks. It was also noticed that insects were present in a considerable proportion of decayed poles, white ants especially contributing to injury. Round-headed and marine borers were likewise responsible for considerable damage. As checks were noticed in a large number of poles containing white

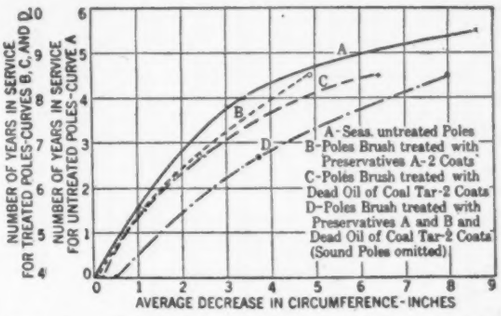

NUMBER OF YEARS IN SERVICE FOR TREATED POLES-CURVES B, C, AND D
NUMBER OF YEARS IN SERVICE FOR UNTREATED POLES-CURVE A
AVERAGE DECREASE IN CIRCUMFERENCE-INCHES
A
B
C
D
A-Seas. untreated Poles
B-Poles Brush treated with Preservatives A-2 Coats
C-Poles Brush treated with Dead Oil of Coal Tar-2 Coats
D-Poles Brush treated with Preservatives A and B and Dead Oil of Coal Tar-2 Coats (Sound Poles omitted)

FIG. 2—EFFECT OF TREATING JUNIPER POLES

ants, it might follow that their presence was facilitated by the free access afforded by imperfections in the wood.

The study showed that success with the brush treatment can be expected only when it is applied to seasoned poles, it being desirable that the part of the surface to be protected by the preservative should be dry and thoroughly cleaned. The preservative, preferably heated to 150 deg. or 200 deg. Fahr., was applied to the cleaned surface by means of a brush. The best results were obtained by applying a second coat. For the usual case of heavy decay concentrated at the ground-line section a treatment extending from 1 ft. above the ground line to 2 ft. below is sufficient.

Treatment with coal tar was found to be ineffective in preventing decay, as the tar formed only a superficial coating, the poles so coated deteriorating practically to the same extent as untreated poles. There was no indication that decay, once it starts, will proceed more rapidly on treated poles than it does on untreated poles.

Ways of Cleaning Steam Condenser Tubes That Save Time

Clean tubes mean as much to economical heat transfer in a condenser as in a boiler. The scale that forms in the tubes has even a greater effect on the transfer of heat than the scale in boiler tubes, owing to variations in the temperature of cooling water available. To maintain the best economy a record of condenser temperatures should be kept, and any abnormal deviation from the average should be carefully analyzed for the cause. This cause is generally the presence of dirt and foreign matter in the condenser tubes and passages. Where performance is carefully watched a serious accumulation of dirt and sludge cannot occur, but in other cases the sludge is present in such proportions that its removal becomes a serious problem.

Where the condenser is of a reasonable size and plenty of time is available, it is advisable to clean and inspect each tube individually. This cleaning can be done by running the regulation condenser-tube brush through the tubes and then flushing them out with a stream of water at a high pressure. Usually either the brush or the water used alone will suffice. An ingenious scheme that has been successfully used to clean tubes consists of cutting leather washers of a diameter corresponding to that of the tube and passing a tenpenny nail through the center of each. A couple of these washers are pushed into the tube and blown through by air at a pressure of 80 lb.

to 100 lb. They pass through the tubes, pushing all muck and dirt before them, and are discharged into a canvas placed at the other end. Here they are cleaned by washing and stored away for use at another time.

These methods demand a considerable expense of time and labor which cannot be afforded in every power station. Where the condenser is large and the time to be devoted to cleaning is limited, the scale may be baked off. In this method the water is drained from the tubes and passages, and the by-pass valve around the steam throttle is "cracked," admitting enough steam into the condenser to maintain a temperature of 150 deg. to 200 deg. Fahr. for a period of several hours. This treatment bakes the sludge in the tubes, causing it to curl up and dislodge itself from the metal. The condenser may then be allowed to cool off. When the pumps are started, the circulating water will remove the dirt. This method is of value when the tubes are in a fairly clean condition, and it can be applied periodically. Where the tubes are stopped up or very dirty, it is advisable to use the brush or similar means.

Overhead Concrete Ducts for a Factory Distribution System

Extending over the roofs of the American Manufacturing Company's Brooklyn plant is a concrete duct line through which all of the main feeders supplying energy to about 5000 hp. in motors are run to branch distribution lines. This construction was found necessary since the switchboard from which the main circuits are controlled is in such a location that it was impracticable to run the cables underground, through the building or on poles outside. Exposed wiring was undesirable on the roof because of difficulties which would have been involved in installing and maintaining it, liability to lightning disturbances, and exposure to weather.

The circuits from the switchboard were therefore run up the wall to a duct house on the roof through fiber ducts inclosed in cinder concrete covered by asbestos panels fastened with iron straps. There the cables were separated into their conductors, taped and clamped in porcelain blocks. After passing through the clamping blocks the conductors were again grouped into circuits and run through concrete-incased fiber ducts

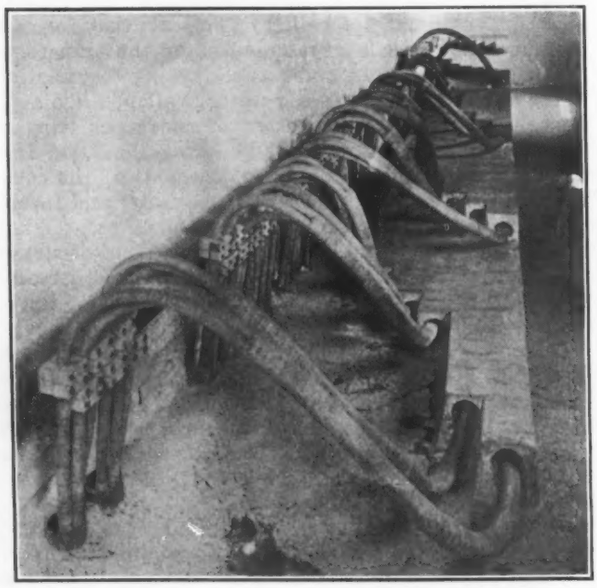


FIG. 1—NINETEEN FEEDERS FROM SUBSTATION RISERS, SHOWING ENTRANCE TO CONDUIT RUNNING ALONG ROOF

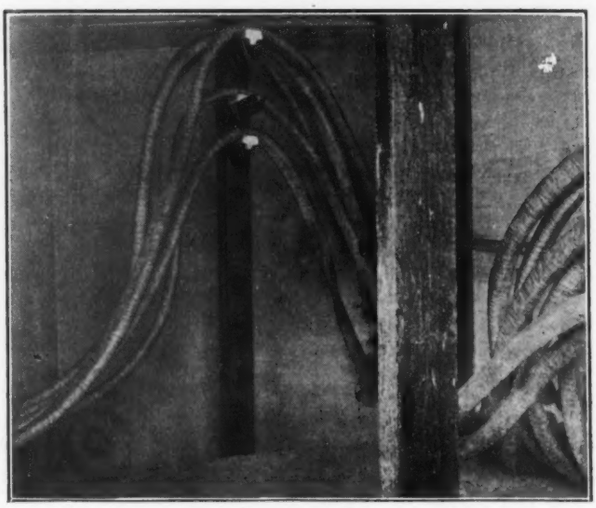


FIG. 2—INTERIOR OF ONE OF THE ROOF DUCT HOUSES

extending over the roof. As shown in Fig. 1, the duct line is six ducts wide and five layers high, each duct starting at a point opposite the outlet from the substation below. At present only nineteen of these ducts are used, leaving eleven ducts for cables which may be required as the factory equipment is increased.

At intervals along the roof are other houses inside which some of the ducts open and allow cables to be run into vertical, lateral and inclined conduits leading to points of distribution. The cables supplying energy to sections of the factory near the substation have been placed in the upper ducts, while those feeding the more remote loads are in the lower ducts, thus making it unnecessary to break the continuity of any ducts except those connecting with branch lines. As shown in Fig. 2, the emerging cables are draped over porcelain seats resting in V-section brackets attached to uprights.

Wherever cables are not protected by conduit they are wrapped with rubber tape covered with a layer of 0.25-in. asbestos listing and painted with two coats of silicate of soda to prevent injury by flames or arcs. Owing to the weight of the concrete duct line (762 lb. per linear foot) and the fact that the roof was not designed to carry this load, parallel I-beams were molded in the lower side of the concrete nest to transfer the weight to the building walls.

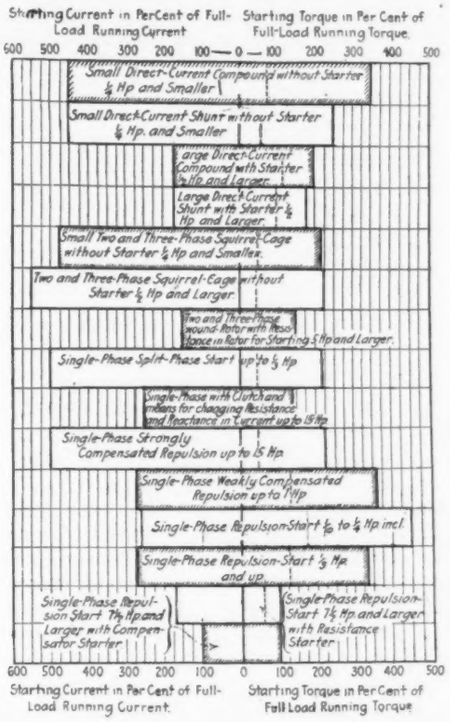
Points to Consider When Locating Meters and Load Limiters

For locating meters and load limiters several valuable suggestions have been offered by members of the meter department of the Metropolitan Electric Company, Reading, Pa. First of all a location should be selected where there is the least vibration. This is usually found near the ground and not on the upper floors of a building. A very convenient way of judging the amount of vibration is to grip a pencil between the teeth and press its point firmly against the wall or place which is contemplated as a support. Constant vibration will affect the accuracy of meters and may in time destroy the bearings. Too much vibration affects the operation of load limiters more than meters as it impairs the load adjustment.

Locations where extremes of heat and cold, exposure to dust, moisture or chemical fumes will be encountered should be avoided. Under no consideration should meters be installed in bathrooms, kitchens, or other places inconvenient for meter readers or where their visits may annoy customers.

Data on Starting Torques and Starting Currents of Various Motors

When installing a motor drive one of the first essentials is to study the power requirements of the machine to be driven. If the machine is started and stopped frequently and is not driven from a line shaft operating several other units, it often happens that the starting torque required will be the governing factor in selecting the motor. This torque may be ascertained approximately by attaching a strip of wood or metal at right angles to the shaft and suspending a known weight from it at different distances from the axis until a position is reached where the shaft turns. The distance (in feet) between the line of the turning force and the shaft multiplied by the weight (in pounds)


Starting Current in Per Cent of Full-Load Running Current
Starting Torque in Per Cent of Full-Load Running Torque
600 500 400 300 200 100 0 100 200 300 400 500
Small Direct-Current Compound without Starter ½ Hp and Smaller
Small Direct-Current Shunt without Starter ½ Hp. and Smaller
Large Direct-Current Compound with Starter ½ Hp and Larger
Large Direct-Current Shunt with Starter ½ Hp and Larger
Small Two and Three-Phase Squirrel-Cage without Starter ½ Hp and Smaller
Two and Three-Phase Squirrel-Cage without Starter ½ Hp and Larger
Two and Three-Phase Wound-Rotor with Resistance in Rotor for Starting 5 Hp and Larger
Single-Phase Split-Phase Start up to ½ Hp
Single-Phase with Clutch and Means for Changing Resistance and Reactance in Current up to 15 Hp
Single-Phase Strongly Compensated Repulsion up to 15 Hp
Single-Phase Weakly Compensated Repulsion up to 7½ Hp
Single-Phase Repulsion-Start ⅛ to ½ Hp incl.
Single-Phase Repulsion-Start ⅓ Hp and up
Single-Phase Repulsion Start 7½ Hp and Larger with Compensator Starter
Single-Phase Repulsion-Start 7½ Hp and Larger with Resistance Starter
600 500 400 300 200 100 0 100 200 300 400 500
Starting Current in Per Cent of Full-Load Running Current
Starting Torque in Per Cent of Full Load Running Torque

RELATION OF STARTING TORQUES OF DIFFERENT TYPES OF MOTORS WITH CORRESPONDING STARTING CURRENTS

The portions of the bars extending to the right as far as the dashed lines represent relative values of torques when the starting current is limited to full-load value.

gives the approximate starting torque. A spring scale applied at a definite distance from the shaft may be used instead if desired. The running torque can be obtained by finding the force and distance of application required to keep the shaft turning.

The ratio of the starting torque to the running torque is an important value, especially if the machine must be started under load. Before this ratio can be used in selecting the type of motor to employ, however, the horsepower required to carry full load should be known. This may be obtained from the manufacturer of the machine or can be measured by a dynamometer test. A rough estimate can be obtained by multiplying the running torque previously measured by the revolutions per minute and dividing by 5250. Knowing the horsepower required and the ratio of starting torque to full-load torque, the accompanying chart may be of value in selecting the type of motor to use. The data on which this chart is based were presented before the American Institute of Electrical Engineers by James L. Hamilton in a paper entitled "The Repulsion-Start Induction Motor."

Reasons for Corrosion of Steel Smokestacks and Ways to Prevent It

BY R. I. ELKIN

The discovery that a number of steel smokestacks throughout the country are corroding at an alarming rate has aroused much interest among central-station companies, insurance interests and others. A superficial inspection of the exterior of many of these stacks indicates that they are apparently in a satisfactory condition, but when scrutinized on the inside it is found that disintegration in many cases is proceeding rapidly. Of the stacks examined a few were lined, and these were free from attack. Those without any lining whatsoever were, however, deteriorating in practically every case.

A steel stack will corrode on the inside and on the outside, but this fact appears to have been overlooked in many instances, for protection has been given the exterior while the interior has been ignored, although internal corrosion is by far the more serious of the two. Corrosion of the outside of a stack is due in part to the elements and in part to acids and sulphur fumes, which attack steel quite rapidly in the presence of moisture. An inexpensive way to prevent corrosion is to paint the steel with a suitable pigment. The conditions affecting a smokestack are similar to, but much more severe than, those existing round other steel work, bridges, etc., on account of the atmospheric conditions and the rather high temperatures—a combination most favorable to corrosive action. The painting should be thorough, and not less than two coats should be applied, otherwise the pinhole abrasions in the paint and uneven coating may give a covering which is not completely protecting. To obtain the benefits of painting it should be done regularly, the frequency depending upon local conditions. About every two years suffices in average cases.

It is a less simple matter to prevent corrosion in the interior of a stack, and one which will cost more than outside protection, because the hot flue gases direct from the fires must be contended against. These gases are extremely corrosive and will cause rapid disintegration of the steel if preventive means are not taken. The corrosion is due almost wholly to the flue gases containing moisture, which condenses against the comparatively cool walls of the metal stack. The condensate thus precipitated consists largely of sulphurous acid, while there are always present the deleterious effects of carbon-dioxide gas, which attacks steel in the presence of moisture. The remedy for corrosion on the interior of a stack is to protect the metallic wall from the acids and gases by lining with firebrick. This lining should be carefully laid, care being taken that no air gap exists between the lining and the metallic wall, otherwise the corrosion will take place as fast as, if not faster than, when no lining is used. The intervening space between metal and brick should be filled in completely by grouting with cement. The lining should go the full height of the stack, because with unlined stacks it has been found that the upper rings corrode faster than the lower, owing, no doubt, to the greater condensation at the top of the stack.

One of the things most conducive to corrosion is to take an unlined stack out of service from time to time, even for short periods. Experience, however, seems to indicate that allowing a stack which is properly lined to stand idle has little effect upon corrosion. This is a great advantage to steam plants operating in connection with hydroelectric plants where the water supply is erratic or insufficient at all periods of the year. A further advantage of lining a stack, besides that of protecting it and thereby prolonging its life, is that the radiating losses through the metallic walls are very materially reduced, thus improving the draft.

Marketing Electricity

A Department on Selling Service and Widening the Use of Electrical Energy

A "Baby Bond" That Guarantees Paid Bills

How a Coupon-Bearing Certificate of Deposit Has Solved the Problem of Collection Insurance at Oklahoma City

By George B. Saunders, Oklahoma Gas & Electric Company

METER deposits have ever been a cause of trouble between the public and the central station—a breeding point of discontent—and yet no more satisfactory way has yet been found to insure protection in situations where the credit of the customer does not meet the requirements of the company. And so the salesman has had to ask for a deposit of cash to be held as security for the payment of bills and the return of the meter, and much misunderstanding has naturally followed in countless cases. You cannot blame the householder, who looks upon it as a reflection on his responsibility and honor; you cannot blame the central station for protecting itself where protection is apparently necessary. It has been overdone, of course. It has been handled with scant tact. It has occasioned a lamentable amount of trouble in many cities where the matter has not been discreetly regulated. But in Oklahoma City we have found a way to make each depositor realize that such a payment is actually an investment of the most substantial and profitable kind. We issue him a "baby bond."

The Oklahoma "Baby Bond"

This "baby bond" feature was inaugurated by Henry Willmering, chief accountant of the Oklahoma Gas & Electric Company, as offering an opportunity to popularize the company by teaching its patrons how to invest their money safely in bonds that are free from income tax. At the same time the company is itself protected against loss through failure of a customer to pay his bills. These bonds are actually interest-bearing certificates of deposit, printed handsomely, in the style of standard bonds, with coupons attached to cover the payment of interest at 5 per cent for a term of nine years. The bond reads:

Certificate of Deposit No. 1011, Series A.

This certifies that John Smith has deposited with Oklahoma Gas & Electric Company five dollars as a guarantee for the payment of all bills for electric current consumed at 815 Davis Street, in the city of Oklahoma City, Oklahoma. Such deposit, less such amount as consumer may owe, to be refunded upon expiration of contract now existing and in force between parties hereto and named hereon. We promise to pay interest thereon at the rate of 5 per centum per annum, payable July 1 in each year, upon presentation and surrender of the respective coupons hereto annexed as they severally become due.

Not transferable. Not good unless countersigned.

THE OKLAHOMA GAS & ELECTRIC COMPANY,
Date issued, July 1, 1915. By F. A. Whitten, Treasurer.

The coupon reads:

OKLAHOMA GAS & ELECTRIC COMPANY.

on the first day of July, 1916, will pay to original owner hereof twenty-five cents, being one year's interest on Certificate of Deposit No. 1011. This coupon payable at the office of the company when indorsed on the back with signature of original owner.

F. A. WHITTEN, Treasurer.

The size of the deposit required in Oklahoma City is governed entirely by the average winter bill shown at the place where application is made for service by the customer. Among the rooming houses the deposits naturally run high, often $50 on each gas and electric meter.

How It Is Issued

The regular deposit for a home is usually $5 on each meter, or $10 covering service of both electricity and gas. For each $5 received the company issues to the customer a baby bond which is held by him and from which he clips his coupons. On the first of each July or during the month these coupons, properly indorsed, are presented to the cashier and are redeemed either by paying the consumer the cash or by applying the interest upon current bills. The date upon the back of the first coupon indicates whether it is good for a year or a fractional part thereof, all chance of error being therefore eliminated. After payment is made the value of the coupon is written plainly across the face of the coupon and the date of payment stamped upon the back.

Before the advent of the coupon bond thousands of post cards had to be made up annually, showing the amount and number of deposits and the interest due, and then checked against the deposit records and consumers' ledgers, and finally mailed to the patron. This process involved weeks of night work, and great con-

THE OKLAHOMA CITY DEPOSIT BOND AND COUPONS THAT HAVE PUT AN END TO MANY TROUBLES BETWEEN CENTRAL STATION AND CONSUMER

fusion and much strife resulted from the rush of customers to the office, where naturally all could not be served promptly. The old certificates called for a payment annually of 5 per cent interest, but the consumers evidently did not read the certificate or consider the interest item.

And there is the most important point of all. It is a matter of psychology. To tell a man that his money will be returned and that interest will be paid, or even the issuance of a certificate with the information plainly printed on it, is not like handing him a coupon bond as an investment bearing conspicuous coupons that call for definite amounts of interest money on definite dates. We have found that our customers are highly pleased with the idea, and it is surprising to see how it pleases them to get this 25 cents or 50 cents every July. At the same time the customer knows that his money is as safely invested as if in a government bond, and at a higher rate of interest.

What the People Say

In fact, it is really unusual to hear an applicant protest at the amount of deposit required after he understands the principle involved. He joins in the spirit of a transaction that creates an investment for him. I really believe it has stimulated the "savings idea" with many, and most persons realize how important this fundamental principle of learning to save is. Many of our leading business men have applauded this simple little scheme as a wholesale lesson in economy and investment.

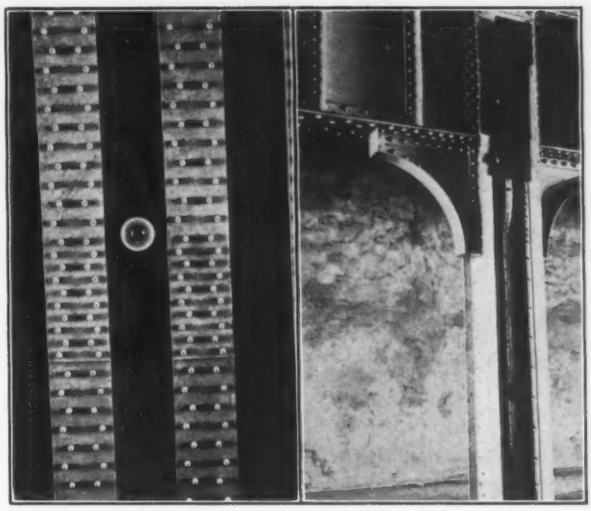
"This beats the bank's 4 per cent" is one of the remarks frequently heard. "A fellow oughtn't to kick about buying bonds that pay 5 per cent" is another familiar expression in the office. There seems to be an unusual attraction in the beautifully engraved baby bonds. Patrons walk away from the contract department reading and examining this new document that represents their bond holdings with the company, and they are interested.

In short, this "baby bond" of ours has proved to be a wonderful influence for producing a broad, wholesome smile upon the face of the consumer when he walks up to the cashier and receives a bonus from the gas and electric company. It is real, "sure enough" money handed out to him by a public utility—a big corporation—and he likes it. It takes the curse off of the meter deposit, and we recommend it heartily to other central stations.

Improved Lighting of Bridge Underpass at Springfield, Mass.

The Water Street underpass at Springfield, Mass., carries the highway beneath nine steam railroad tracks and is a thoroughfare of increasing importance. The lighting of this underpass has, therefore, presented a problem of interest in connection with its recent construction. The work was planned under the direction of William E. Hodge, deputy superintendent of street lighting at Springfield. Seven 100-watt tungsten lamps housed in Holophane intensive reflectors furnish the illumination, which is declared to be adequate from every point of view, despite the small consumption of energy required.

The roadway through the underpass is 200 ft. long and is bordered by a walk on each side 9 ft. in width. The lamps are staggered, being erected in rows outside the curb at a height of 14.5 ft. above the roadway. Each unit is mounted between the heavy girders of the bridge as is shown at the left of the picture, the feed being through iron conduit. The lamps are operated on a 110-volt multiple circuit controlled by a time switch



LIGHTING OF UNDERPASS AT SPRINGFIELD, MASS.

mounted in a cast-iron box between the bridge columns, as shown at the right, the main feed being by underground iron conduit.

Striking Form of Load-Curve Chart Used to Obtain Municipal Loads

Having found that it was extremely difficult to make the average city council or the average city superintendent of a municipality owning its own distributing system and plant for electric lighting realize how a low load-factor means a considerable loss due to idle investment, the Georgia Railway & Power Company, Atlanta,

TYPE OF REPORT EMPLOYED

Average demand, kw	26
Kilowatt-hours per day at average demand	624
Kilowatt-hours per day if maximum demand is used twenty-four hours	2,424
Load-factor, per cent	25.7
Idle factor, per cent	74.3
Horsepower maximum demand	134
Value of machinery	$6,700.00
Interest and depreciation (17 per cent)	$1,139.00
Loss in interest and depreciation on account of idle factor	$846.00
Interest and depreciation charge per actual kilowatt-hour.	0.5 cent
Interest and depreciation charge per day	$3.13
Coal, fireman, incidentals, interest and depreciation, per kilowatt-hour	2.68 cents

Ga., now makes use of charts such as that illustrated. By using such charts and calling attention to the results of an idle investment by means of a report such as that shown, the company, according to a paper presented by W. Rawson Collier before the Southeastern Section of the N. E. L. A., has found it a comparatively easy matter to convince city councils that the non-use of a steam plant throughout the greater portion of a day means a loss and that purchased energy may be cheaper.

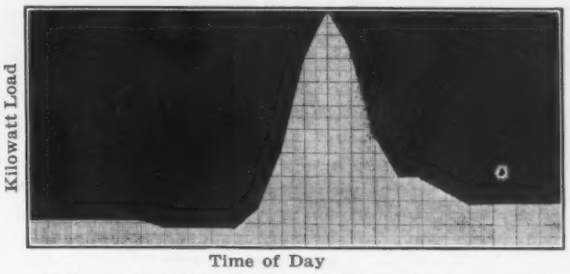


CHART TO SHOW TIME INVESTMENT LIES IDLE

The Place of the Middleman—the Jobber

Relations of the Electrical Jobber to the Other Branches of the Industry and to the Public, as Pointed Out Before the Jovian Convention in Chicago

By W. R. Herstein, Treasurer Electric Supply Company, Memphis, Tenn.

WHILE the merchandise jobber of to-day is purely and simply a middleman and makes little or no claim to being either a creator of demands or a producer of supplies, he is performing a service which nearly a hundred years of experience have shown to be well worth the small percentage of expense he entails upon the manufacturer, the retailer and the consumer.

With regard to the manufacturer, it should be borne in mind that from the day the village blacksmith ceased making his own horseshoe nails and the spinning wheel became silent no industry has been more dependent upon highly capitalized and well-equipped manufacturing plants than is the electrical industry. In no line of endeavor has individual effort so completely disappeared. The jeweler may still fashion an ornament suited to your personal tastes, and the shoemaker turn out his own idea of a perfect fit, but the electrician's goods are made in huge factories and must be Code standard. He is therefore precluded from becoming his own manufacturer.—*The Author.*

How to supply the electrician, whether contractor or retailer, becomes, consequently, the question for the manufacturer. Shall he add this problem of distribution to his other problems of manufacturing, finance and labor, or shall he follow the trail already blazed by manufacturers in other lines and market his product through the jobber?

On the one hand, he sees hundreds, perhaps thousands, of possible customers scattered throughout the country, some easy, some difficult of access, some of them representing substantial financial interests and others rated blank by the mercantile agencies. Perhaps he may have a vision of dozens of his traveling salesmen spreading over the various States and making a more or less successful effort to get in touch with all these "prospects." No less certainly will he foresee, if he be wise, just as many expense accounts, to be paid out of the profits of his business, with possibly an equally liberal expenditure for a national advertising campaign. Nor should he blind himself to a high-salaried credit department, whose labors, however incessant and efficient, cannot eliminate credit losses which might have been prevented by a personal visit or long-distance telephone call to the customer, were it not for the fact that the customer is a thousand miles or so from the credit department's office.

On the other hand, he may elect to market his product through the jobber, in which case he finds, if he desires to cover the entire country, a hundred or so of substantial units fitted by years of careful and thoughtful experience to present his wares to his thousands of possible retailers in a thorough and efficient manner. Practically all these units, he will find, are already well established in the business life of their respective communities, represent an unusually high grade of credit risk, and can handle his product at a cost to the manufacturer which is certainly less than that of his proposed expensive corps of salesmen, his office employees and his advertising program. Best of all, he can determine with certainty his entire expense of distribution. Incidentally, he should not overlook the possibility of increasing sales by having a stock of his wares within easy reach of his widespread retail trade, instead of forcing his retailers to rely upon shipments from a factory hundreds or thousands of miles away.

As between the jobber and the retailer or contractor, it is immediately apparent that the principal value of the former to the latter is that of a warehouseman. In this respect, at least, and perhaps in others which will be named later, the same remark applies to central stations, street railways and telephone companies. By aggregating at one central jobbing point, easy of access, a vast variety of electrical products it becomes possible for the retailer to carry on a much more extensive business than would be possible were he compelled to rely upon shipments from distant factories. In many instances lack of capital itself would prevent him from carrying the heavy stocks which alone justify factory shipments. In other cases numerous sales would be lost and much construction work would be delayed by inability to procure supplies promptly. While I realize that there is a tendency on the part of many contractors to ignore the jobber and to deal with the factory direct, I will venture the assertion that there is not one of them who is not in the course of a month forced to fall back upon some jobber's stock to take care of his necessary requirements. In this connection it is to be remembered that I am classing the street railway, telephone company and central station with the contractor.

The Traveling Salesman Is Expensive, but Nevertheless Necessary

Next to his warehouse comes the jobber's salesman. I have spent many years of my life in the electrical jobbing business, have seen many business policies tried out, and have had under consideration numerous schemes for the efficient exploiting of electrical supplies, but I have yet to be convinced that an electrical-jobbing business can be successfully conducted without the traveling salesman. We have seen so-called cut-price houses, demanding cash in advance, spring up like mushrooms in different parts of the country. Enticing net price lists are issued by the ton, making frequent reference to the elimination of such expensive items as traveling salesmen and credit losses. We all know what usually happens to the customer who advances money to these houses. The traveling salesman costs us money, but we must have him. He is the friend of the contractor, the retailer and the operator, and he makes friends of them for his house. The retailer can have no better friend and the jobber no better asset than a crew of intelligent, loyal and aggressive traveling salesmen.

Last, but by no means least, of the services rendered the contractor by the jobber is credit accommodation. For customers without ratings to establish credit relations with distant manufacturers would be difficult, to say the least, and the necessary delays ensuing would work great hardships on the buyers. Here the jobber and his salesman again step in. It is their business to know whom to trust. In taking this burden upon himself the jobber renders a valuable service to both manufacturer and retailer. As a matter of fact he benefits the entire community, for the limiting of credit is as important as the giving of it, and many an incipient case of bankruptcy has been curbed by the wisdom of a jobber's credit man, who, with his salesman, is keeping a close watch upon some ambitious customer beset by the temptation to extend his business beyond the capacity of his combined capital and credit.

"Down with the Middleman!" the Cry of the Public

Having, as I hope, established the case for the jobber as regards the manufacturer and retailer, let us look at him from the customer's standpoint. Here the popular cry of eliminating the middleman reaches its climax. The general public has little use and less concern for anyone or anything that does not give it full value for its money. Ties of personal friendship and business policy do not exist between commercial enterprises and the public. The matter resolves itself into this simple question: "Can you give us a full measure of service for the compensation you ask, and can you continue doing this year after year, in good times and bad, maintaining yourself by your own efforts throughout alternating periods of prosperity and adversity? If so, then you may have the privilege of serving the public, and possibly retiring with a competency for your old age."

These demands are met by the jobber in various ways. First of all, he makes possible the vast number of retail establishments, placing within easy reach of the public those conveniences and necessities which the science of electricity has provided. He follows this up by seeing to it, through his enterprising salesmen, that the retailer shall carry in stock the latest developments of this remarkable science; that these devices may be had at reasonable prices, and that at certain periods of the year seasonable articles, some of which have now become absolute necessities, are to be had in such quantities as may be required. If the jobber has the real best interests of his class at heart, he will see to it also that such products as pass through his hands shall be of high quality, safe in design and workmanship, and calculated to reflect credit upon the industry he represents.

FLUSHING BALTIMORE STREETS WITH AN ELECTRIC TRACTOR

Using the Electric Tractor in Street-Cleaning Service

The flushing and washing of streets is now being done electrically in Baltimore. During the summer the city used a 2-ton electric tractor for pulling a street-washing machine. In the winter the tractor will be attached to a snow scraper or ash cart. The tractor is of the General Motors Company's manufacture and was purchased in June through the Consolidated Gas, Electric Light & Power Company of Baltimore. It is equipped with a 300 amp.-hr. sixty-cell Edison battery. The cost for energy consumed is about $40 per month. Outside of this charge and the cost of garaging there have been no other expenses during the five months the tractor has been in service.

"You Can Buy It Right Here in Town"—A Publicity Point Well Worth Emphasis

Early in October the business interests of Benton Harbor, Mich., conducted a fruit festival which was in effect a carnival celebrating the culmination of the harvest season of southern Michigan's luscious products. One feature of the affair was the electrical exhibit staged by the Benton Harbor-St. Joe Railway & Light Company aided by a number of electrical manufacturers. Under the supervision of John A. Cavanaugh, superintendent of light and power, everything electrical was exhibited from a farmer's motor-driven pump and grinder set to an electrical refrigerator.

As the result of taking the reporters into the company's confidence, the local newspapers made much of the completeness of the display and in two-column headlines featured the fact that, with but two exceptions, all of the electrical devices shown were carried in stock

THE HOME MARKET FOR ELECTRICAL GOODS DEMONSTRATED IN CARNIVAL EXHIBITS AT BENTON HARBOR, MICH.

by the local central-station company. That any of the goods displayed could be purchased "right at home" was again set forth in the text of the newspaper story of the festival.

"The tendency," declared the show's knowing publicity agent, "is for the visiting public to believe that the electrical manufacturers import the exhibited material only for the show and return it to their factories when the gala week is over. That the favorable attention attracted by the show may have lasting benefit this prevailing idea must be uprooted. The public must be informed that the electrical devices they have seen are not mere show goods but are parts of actual stock carried in their home town. In the newspaper stories of such displays it seems important, therefore, to have incorporated and emphasized, if possible, the fact that anything seen at the electrical show may be seen again and may be purchased from the stock of a local dealer."

Induction Motors Operate Safely in Explosive Gases of Benzol Plants

The squirrel-cage induction motor finds an almost ideal application in the benzol plants which are now being erected to produce by-products from the gases given off from the coke ovens operated by American steel companies. The usual products of these plants are benzol, toluol, xylol and solvent naphtha. These are now in great demand in this country, since the war has produced a curtailment of their importation and also because of their use in the manufacture of explosives.

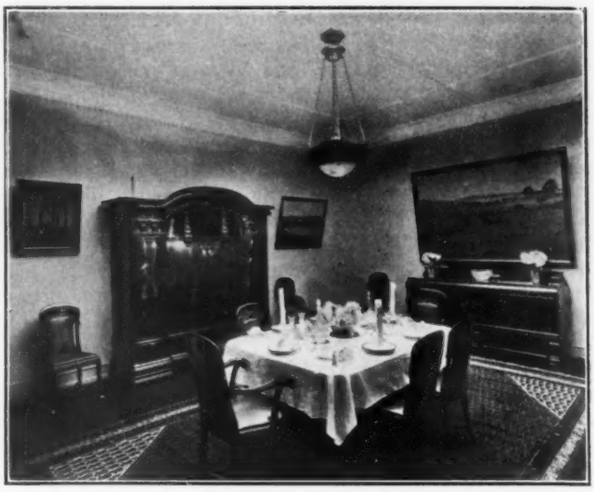
Owing to the highly explosive nature of the gases in benzol plants the squirrel-cage induction motor with oil switching and starting equipment is emphatically recommended instead of direct-current motors with knife switches and air-gap circuit-breakers.

The benzol plant is even more liable to explosions than is a powder factory. The explosive gases being heavier than air, their dispersal by ventilation of the usual sort is impossible. No matches or open flames of any sort, and no riveting or hammering which might produce sparks, are permitted in the plant. This rule applies not only to the benzol house, wherein are installed the stills, washers, etc., but also to the pump house, naphthalene building and shipping building, and to the yards, where there are storage tanks, piping, scrubbers and other equipment. An explosion occurred in works in Europe where the heavy gases banked against the wall of a building not in the benzol plant and at a considerable distance from it.

Electric lamps should be placed in such locations that they will not be broken, the wiring must be amply protected to prevent short-circuits and grounds, and the switches should be of such a nature that no spark or arc results during their operation.

Encouraging Employees' Bank Deposits

In a letter of recent date Donald McDonald, vice-president and general manager of the Louisville (Ky.) Gas & Electric Company, points out to employees of the company the advantage of each person having a bank account. Aside from inculcating habits of thrift, a bank account, declares Mr. McDonald, saves its possessor the customary charge for cashing pay checks, eliminates the risk involved in carrying money in pockets and adds undoubtedly to the credit and self-respect of the depositor. The company's paymaster has also been instructed to deposit employees' checks regularly in down-town banks if such action is authorized by the employees.



SEMI-INDIRECT LIGHTING OF DINING-ROOM WITH A SINGLE 200-WATT LAMP

Semi-Indirect Lighting for a Dining-Room in Sweden

The accompanying illustration shows the attractive display room of the Nordiska X-Ray Reflektor A.-B., Malmo, Sweden, which has been arranged in the style of a typical Swedish dining-room and illustrates the application of semi-indirect lighting to such an apartment. The central lamp, which has a luminous bowl of armit, imitating alabaster, contains a 400-cp. gas-filled tungsten lamp taking 0.5 watt per candle. The room is also equipped with direct lighting from lamps at the four corners of the cornice. Each fixture contains an ordinary 50-watt lamp, or a total about equivalent to the 200-watt demand of the central fixture. An automatic switch provides for turning the direct illumination off simultaneously with the lighting of the central fixture, so that the two forms of lighting may be compared by those interested in residence lighting under favorable conditions for arriving at correct conclusions.

Economy of the Electric Truck for Delivering Coal —Unit Costs Compared

Comparative costs of coal delivery by electric and gasoline trucks and by horse-drawn wagons at Hartford, Conn., are shown in the accompanying table prepared by the Hartford Electric Company.

COST OF COAL DELIVERY, PER MONTH, BY ELECTRIC TRUCKS, GASOLINE AND HORSES

Type of Vehicle	Miles	Tons Delivered	Cost per Ton, Cents	Cost per Ton-Mile, Cents
One-horse (chute) wagon	339.0	398.0	44.9	15.0
One-horse (bag) wagon	398.0	326.9	51.5	14.1
Two-ton gasoline truck	897.0	270.8	96.5	14.8
Two-ton electric truck	961.0	415.1	66.2	13.8
Five-ton gasoline truck	553.9	470.0	62.2	12.4

The 2-ton electric truck covered more miles and delivered more coal than either the 2-ton gasoline or the 5-ton gasoline truck. W. M. Thayer of the Hartford Company recently announced that under the battery-service system at Hartford trucks have now run 1,500,000 miles. A reduction in the rates charged was effected last July.

From the Customer's Viewpoint

Improvements in Service and Products That May Follow from Looking at Everyday Transactions as the Customer Sees Them

Speaking the Language that the Customer Knows and Can Understand

A lady entered a contractor's store one day last summer, stepped over a dozen lengths of iron conduit that lay across the floor, held back her white skirt so it wouldn't touch a dirty-looking coil of wire that stood beside them, and walked around a man in greasy overalls, who stood there talking to the man behind the counter, preliminary to taking this material out to the job. She waited a minute till the clerk came. Then she asked the price of medium-sized fans.

"A.C. or D.C.?" asked the clerk.

Appliances and Motor Cars—Both Undergo Improvements

This story comes from the salesmen of the Pacific Gas & Electric Corporation. The incident occurred recently at the Exposition. A woman stood looking at a range when the salesman approached and offered to demonstrate it.

"No," she said, "don't bother. I have one now and it doesn't seem to work very well. I don't think much of them."

"How long have you used it?" he asked.

"About five years," she said.

Five years she had used it, and yet she didn't think much of it and she didn't care to look at any other!

The salesman was struck with the incongruous situation and had a happy thought. He asked her if she owned an automobile. She did. "What make and model is it?" he asked. She told him. It was a 1915 model, and it was the owner's habit to "trade in" the old machine each year and get a new one with the latest "fixings."

"Don't you realize," the salesman then said, "that there have been improvements in these ranges in the last five years, just as there have been in motor cars? The old range has given you longer service than you ask of your motor car. Why not trade it in and take advantage of the better features of the newer model?"

A Case of Confidence Thrown Away

In a suburb of New York last spring a new house was built on a large estate, and service was wanted from the electric-light company. It necessitated a line extension of about 300 yd., though telephone poles were available for the entire distance. Application was made, and after some delay the applicant received a letter stating that seven poles would have to be set to make the connection and that they would have to charge him $150 for the extension.

Now, it happened that this prospective customer had not long before sold to this central station for $4 each a considerable number of chestnut poles cut on the estate. The difference in the price was interesting. It also happened that, a year or so before, this lighting company had made a proposition to his father for providing service to the homestead on the same estate, about 200 yd. away, and stated that the telephone poles could be utilized. All this was brought to the attention of the district commercial manager, who relayed it to headquarters, and another wait followed.

Then came another proposition—this time they would do it for a flat $50; but this also was refused, whereupon it was suggested that this $50 would be paid back as soon as the other house was connected. Then finally the company agreed to make no service charge and promised prompt connection when the new house was completed, yet when the call came there were further troubles. The job would take about three days, they said, and the construction department was very busy. And so the family moved in and waited ten days for light and the power for a water pump, in spite of almost daily exhortations and appeals. Then one day came the crew and strung the line and gave the service in three hours of a pleasant afternoon.

From the customer's point of view it seems unreasonable, unjust, unbusinesslike. Can anybody wonder?

THE RUNNING COSTS OF THE AVERAGE AMERICAN HOUSEHOLD IN COMFORTABLE CIRCUMSTANCES, EXCLUDING OUTLAYS FOR PROVISIONS, RANGE FROM $25 TO $75 A MONTH—HOW MUCH OF THIS MIGHT BE DIVERTED TO THE CENTRAL STATION'S INCOME?

Does Your Public Know the Possibilities of Electricity as Housemaid?

A prospective purchaser of electrical appliances says: "I have a family of six, not counting the housemaid. My wife pays the maid $35 a month, and a laundress for two days $3.50 a week more. My children are growing up and will be taught to help keep house. We have an electric vacuum cleaner and an electric flatiron. Our bill for electricity and gas together averages $10 a month. In other words, I am spending in cash outgo each month $59 for operating costs of my household. I have read about electric helps of various kinds, showing pictures of washing machines operated by babies ten years old, vacuum cleaners in use by little tots in starched Sunday clothes, and happy maids ironing on the back porch. I am interested in but not convinced as to the usefulness of these many devices. Can not somebody tell me just what a modern electric equipment would cost for my nine-room house, how much it would save, who could operate it, who will guarantee its continued operation, and just what it would cost to run in my own town? Does any local lighting company publish such a booklet?"

The Service to the Customer That Goes with Modern Selling

It was after dinner, and the factory manager and his guest—the head of the firm's New York sales office, in town for a two-day conference—had lingered at the table over their cigars. From "talking shop" to talking men was a short step, and the change in the attitude and methods of the modern salesman was the next topic which came under discussion.

"The jobbers' salesman who just comes around in search of orders cannot hope to compete very long in these days with the other jobbers' man who is constantly and conspicuously endeavoring to be of use," commented the man who does the buying. "Theoretically, it would seem as though the one who stuck to heavy selling staples and just pounded for more business would do better than the other chap, who is so constantly interesting himself in opportunities to make suggestions that will be of service to his customer. But, after all, I find that the man who serves is the man who is best liked. The salesman who brings ideas along with him, in addition to his catalogs and order book, becomes a sort of partner in his customer's business, and they prosper together. From the customer's point of view, that salesman is worth too much not to be taken care of."

Technical Advance in Theory and Practice

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

SUBSTITUTES FOR COPPER IN GERMANY

New Regulations of German Association of Electrical Engineers Due to Scarcity of Copper—Carrying Capacity of Iron and Zinc Wires, Zinc Bolts and Busbars

The present scarcity of copper in Germany as a result of war necessitates the utmost economy in the use of copper. To get along without copper altogether is, of course, impossible, since modern electrical engineering without electrolytic copper is as unthinkable as electrolytic copper refining without a dynamo. However, the new regulations of the German Association of Electrical Engineers, published in the *Elektrische Zeitschrift* of Sept. 23, 1915, show how far copper may be saved in ordinary installations when saving is necessary. It is stated at the outset that the situation in Germany demands that copper be replaced by other materials wherever possible, even at the expense of quality and life of the product.

Iron and steel, whenever used for contacts, must be protected in a suitable manner against corrosion, by means of zinc plating, lead plating, proper greasing, or some sort of a cover. Commercial brands of zinc are quite different in their properties. It is necessary to select the proper brand according to the requirements of the special case. In general, when zinc is used, its low mechanical strength, low elasticity, low melting point, and its sensitiveness to high and low temperatures must be taken into account.

TABLE I—PERMISSIBLE CURRENTS FOR ZINC AND IRON WIRE

Cross-Section of Conductor in Sq. Mm.	Highest Permissible Current in Amp.		
	Copper	Zinc	Iron
1.5	14	9	..
2.5	20	11	8
4	25	13	10
6	31	16	12
10	43	23	17
16	75	40	30
25	100	52	..
35	125	65	..
50	160	83	..
70	200	105	..
95	240	125	..
120	280	145	..
150	325	170	..

According to present experience iron and zinc may be used instead of copper in the following apparatus, in addition to bells and contacts and terminals:

Busbars and connections on switchboards: For direct current solid iron may be used for all current densities. For alternating current the skin effect must be taken into account.

Switches: For currents from 25 amp. to 100 amp. inclusive all parts may be made of iron or zinc, with the exception of the spring contacts and the contact points between which the circuit is broken. The contact points must be protected by copper or copper alloys against the action of the arc. This is not necessary in switches in which no arc is formed. Connecting bolts and terminals may be made of iron or zinc.

Plug connections: Up to 25 amp. inclusive all copper or copper-alloy parts may be replaced by iron or zinc. It is recommended that the pins be made of iron, not of zinc. For plugs for 60 amp. the pins must be made of copper or a copper alloy. The other parts may be made of iron or zinc.

Inclosed fuses: For the fuse holders all parts which previously were made of copper or copper alloys may be made of iron or zinc with the exception of the screw sockets, which are made by stamping from sheet copper for fuses over 60 amp. For the cartridges copper or copper alloys may be replaced by iron or zinc. Above 60 amp., however, the connecting pieces for the fuse and the screw sockets must be of copper or copper alloys.

TABLE II—PERMISSIBLE CURRENTS FOR ZINC BOLTS

Highest Permissible Current in Amp.	Diameter of Bolt in Mm.
250	15
350	22
600	32
100	45

Open fuses: Up to 350 amp. all parts, with the exception of contact springs, may be made of iron or zinc.

Lamp fittings and lamp holders: For all parts copper and copper alloys may be replaced by iron and zinc.

Nipples: Iron or zinc may replace copper.

Starters and rheostats: Up to 100 amp. inclusive copper and copper alloys can be replaced by iron and zinc, with the exception of the final contact where an arc is formed. For this the rules on switch construction should be followed. As resistor material iron or a suitable iron alloy is to be used. Screws should be made of iron except in cases in which considerations of eddy current or magnetic conditions require the employment of a non-magnetic material.

Table I gives the permissible currents for zinc and iron wire, Table II for zinc bolts, and Table III for zinc busbars. As to iron busbars, the rule is that in case of direct current the permissible current has the relation of 1 to 2.8 to the permissible current in copper bars of the same dimensions.

TABLE III—PERMISSIBLE CURRENTS FOR ZINC BUSBARS

Highest Permissible Current in Amp.	Thickness and Width in Mm.
25	1.5× 10
60	2.0× 15
100	3.0× 20
200	5.0× 30
350	6.0× 50
600	9.0× 80
1000	12.0× 100

Generators, Motors and Transformers

Dispersion Coefficient of Three-Phase Induction Motors.—E. A. BIEDERMANN.—The dispersion coefficient of an induction motor is defined as the ratio of magnetizing current to short-circuit current. It is the

principal factor which determines the performance of an induction motor. Both the power-factor and the overload capacity of the motor are almost entirely dependent on it. In the article under notice, which is of a mathematical character, the author develops a method of predetermining approximately the dispersion coefficient of a three-phase induction motor from its known dimensions, and shows how the proportions of a motor of given output may be so chosen that it shall have the least dispersion possible under certain given conditions. This means that the power-factor and overload capacity of the motor will be a maximum. The article is to be concluded.—London *Electrician*, Oct. 15, 1915.

Thermal Characteristics and Intermittent Rating.—The first part of an article illustrated by diagrams in which reference is made to the general theory of heating and cooling and values are given of the heating time-constants of various machines. The load-factor method of rating intermittent machines is described and the principles are illustrated by means of examples. In conclusion, an account is to be given of the root-mean-square method of rating.—London *Electrician*, Oct. 15, 1915.

Lamps and Lighting

Daylight Glass.—S. H. GAGE.—An article on a "special daylight glass," "G-172-CD," developed by H. P. Gage for the Corning Glass Works. Fig. 1 shows the distribution of energy in the visible spectrum of the sunlight and of the light from the nitrogen-filled tungsten lamp, and also of the light of the latter lamp when filtered through cobalt glass and the "special daylight glass." The curve for the light filtered through the daylight glass approximates very closely to that for sunlight, especially between wave-lengths 0.45μ and 0.65μ; that is, in the region of the visible spectrum giving the greatest amount of useful light. While light filtered through the proper thickness of cobalt glass may look white to the eye, it gives even more imperfect color values than the unfiltered artificial light. This is intelligible from the violent irregularities of the curve of the light through cobalt glass, and especially the enormous excess in the red as shown in the diagram. The daylight glass is useful for providing artificial daylight for the textile and dye industries, microscopic work, etc. —*Science*, Oct. 15, 1915.

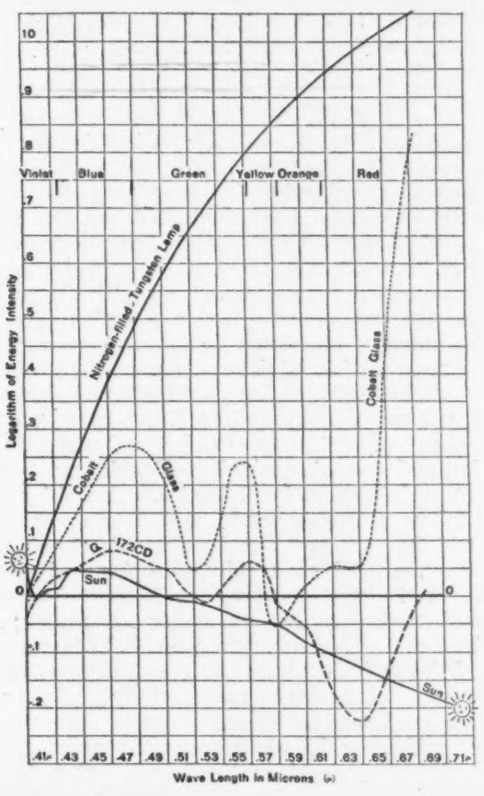


FIG. 1—DISTRIBUTION OF ENERGY IN THE VISIBLE SPECTRUM, AND OF LIGHT UNDER DIFFERENT CONDITIONS

Searchlights.—O. KRELL.—In the concluding parts of his very elaborate and profusely illustrated paper on the use of electricity on shipboard the author deals in some detail with searchlight practice.—*Elek. Zeit.*, Sept. 16 and 23, 1915.

Installations, Systems and Appliances

Lightning Arresters.—C. C. GARRARD.—In a continuation of his long illustrated serial on apparatus for protecting electrical machinery against abnormal electrical conditions, the author takes up the discussion of lightning arresters for direct current, aluminum electrolytic lightning arresters and magnetic blow-out lightning arresters being dealt with. The author then discusses the location of the lightning arrester. Obviously, if the arrester is to protect the station from incoming trouble from the line, it should be placed immediately at the entrance point of the line. The choke coil should be between the arrester and the apparatus to be protected. The earth connection of the arrester is of great importance. If the earth wire makes many turns and twistings, it will possess considerable inductance and prevent high-frequency discharges passing quickly to earth. In Fig. 2 are represented the two extreme cases. The line comes into the building from the left. Diagram A is the worse arrangement, and diagram B, with the short straight earth connection, is the better. It may not always, for constructional reasons, be possible to install the best arrangement, but in any case great attention must be paid to providing a good earth connection as free as possible from induction. The best form of earth plate and making the connections to the earth plate are discussed, and a conical form of earth plate and the use of earth plates in colliery installations are described.—London *Electrician*, Oct. 8, 1915.

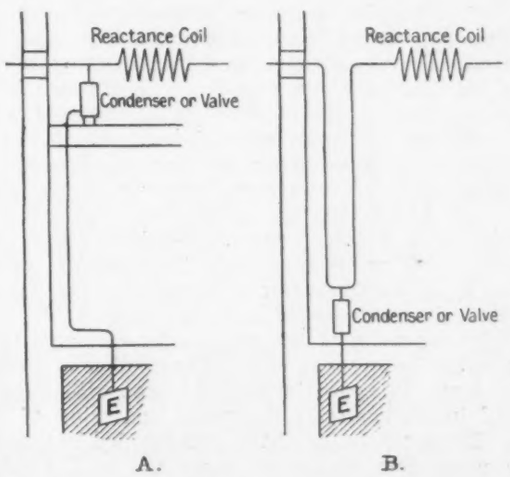


FIG. 2—INSTALLATIONS OF LIGHTNING ARRESTERS, SHOWING WIDELY VARYING ARRANGEMENTS

British Supply Station.—The Suffolk Electricity Supply Company has recently completed an entirely new generating station at Stowmarket, which will practically supersede the old plant. Two four-cylinder, 180-hp. vertical gas engines have been installed, together with two multipolar dynamos. Both sets run at about 250

r.p.m. A rather unusual feature is the plan of drawing the air for the engines through the closed crank cases, whereby the moving parts are cooled while oil leakage is prevented owing to the slight vacuum induced. Naturally, oil separators have to be provided between the crank case and the engine cylinders, otherwise a good deal of oil would be drawn off with the air. This arrangement also prevents any leakage into the engine room of gas which may have got past the piston rings. —London *Elec. Review*, Oct. 1, 1915.

"Point-Five" Tariff.—The "point-five" tariff—officially defined as any scheme under which energy for heating and cooking is obtained at 0.5d. (1 cent) per kilowatt-hour, with or without a preliminary fixed charge—has undoubtedly come to stay. For the present a charge of 1 cent per kilowatt-hour consumed for heating and cooking must in practically every case be supplemented by a fixed charge. The majority of existing "point-five" undertakings assess fixed charges on the basis of ratable value. In the present article it is pointed out that, while this system has the advantage of simplicity, "its fundamental assumption is that ratable value is a reasonably accurate measure of the electricity-consuming capacity of private premises, and the fundamental weakness of the system is that it is not necessarily or even generally anything of the kind." Statistics are given to prove this. Whereas in Sunderland the ratable value percentage charge is increased as ratable value increases (from 10 per cent between £15 and £30 to 15 per cent over £70), the charge in Blackpool is normally 12.5 per cent on assessment and is reduced to 10 per cent on houses rated over £100. The article is to be concluded.—London *Elec. Review*, Oct. 1, 1915.

Electrophysics and Magnetism

Decrease of Velocity of Swiftly Moving Electrified Particles in Passing Through Matter.—N. Bohr.—According to the theory discussed in this paper, the decrease of velocity of alpha and beta rays in passing through matter depends essentially on the characteristic frequencies of the electron in the atoms, in a similar way as do the phenomena of refraction and dispersion. In a previous paper it was shown that the theory leads to results which are in close agreement with experiments on absorption of alpha rays in hydrogen and helium, if we assume that the atoms of these elements contain one and two electrons respectively, and if the frequencies of these electrons are held equal to the frequencies calculated from experiments on dispersion. It was also shown that an approximate explanation of the absorption of alpha rays in heavier substances can be obtained if we assume that the atoms of such elements, in addition to a few electrons of optical frequencies, contain a number of electrons more rigidly bound and of frequencies of the same order of magnitude as characteristic Roentgen rays. The number of electrons deduced was in approximate agreement with those calculated in Rutherford's theory of scattering of alpha rays. These conclusions have been verified by using the later more accurate measurements. In the present author's former paper very few data were available on the decrease of velocity of beta rays in traversing matter, and the agreement between theory and experiment was not very close. The agreement between theory and experiment is now improved materially, partly by using new measurements and partly by taking the probability variations in the loss of energy suffered by the individual beta particles into account. In this connection it is pointed out that measurements on the decrease of velocity of beta rays appear to afford an effective test of the formula for the energy and momentum of a high-speed electron deduced from the theory of relativity. In connection with the calculations of the absorption of alpha and beta rays the ionization produced by such rays is considered. It is shown that the theory of J. J. Thomson gives results in approximate agreement with the measurements if the secondary ionization produced by the electron expelled by the direct impact of the alpha and beta rays is taken into account. —*Philos. Magazine*, October, 1915.

Relation Between the Alternating-Current Conductivity of a Dielectric and Its Change of Capacity with Frequency.—G. E. Bairsto.—The author shows, from the results of J. A. Fleming and G. B. Dyke, that the percentage change of capacity, $(\Delta C/C) \times 100$, of a dielectric for a given range of frequency is a definite function of the alternating current conductivity, and in nearly all cases $\Delta C/C$ is proportional to b, where b multiplied by the frequency represents the main part of the alternating-current conductivity. $(\Delta C/C)/b$ is a constant which is independent of the temperature of the dielectric and its state of moisture content.—London *Electrician*, Oct. 15, 1915.

Specific Resistance of Carbon Steels and the Effect of Composition and Heat Treatment.—Edward D. Campbell.—A long abstract of a paper read before the (British) Iron and Steel Institute in which the author endeavors to add somewhat to our knowledge of the specific resistance of steels of varying carbon content, when these steels have been subjected to different heat treatments, and attempts to point out the relation existing between specific resistance and chemical constitution, with a view to throwing a little more light on the underlying causes of hardness in steel.—London *Electrician*, Oct. 8, 1915.

Electrochemistry and Batteries

Copper Leaching with Electrolysis.—Lawrence Addicks.—A long illustrated paper presented before the American Electrochemical Society giving the results of his large-scale experiments carried out at Douglas, Ariz., on the electrolytic recovery of copper from liquors resulting from sulphate leaching. In this research work a process was developed based upon the depolarizing value of ferrous sulphate, using a carbon anode, the sedative value of aluminum sulphate, thereby restraining the re-dissolving of the cathode copper, and the reduction of the ferric sulphate by sulphur dioxide outside of the cell room. The author discusses in succession circulation and agitation, anodes and depolarization, cathodes and corrosion, sulphur dioxide and reduction of ferric sulphate, and efficiencies. The chief results are as follows: Carbon anodes will stand up in sulphate liquors if they are properly depolarized; aluminum sulphate can be used as a substitute for a diaphragm; 2.25 lb. (1.019 kg.) of copper per kilowatt-hour can be recovered under proper operating conditions; great quantities of various sulphates present as impurities do not foul the cathodes; three or possibly three and one-quarter units of acid are made per unit of copper, of which one and one-half or one and three-quarters units are new acid from the tower gases; no mechanical difficulties are experienced in the tower, but a thorough study remains to be made of the chemistry of reduction of ferric sulphate by sulphur dioxide in order to utilize the roaster gas to best advantage.—*Met. and Chem. Eng'ing*, Oct. 15, 1915.

Manufacture of Cyanogen Compounds.—J. E. Clennell.—A paper summing up recent advances in the manufacture of cyanogen compounds, especially relating to the fixation of atmospheric nitrogen, the production of cyanogen compounds from nitrogenous gases by catalysis and otherwise, and the production of cyanogen compounds from gaseous mixtures by absorption with a metallic salt.—*Met. and Chem. Eng'ing*, Oct. 15, 1915.

Units, Measurements and Instruments

Plotting Hysteresis Curves.—A. YTTERBERG.—A description of a new method of plotting hysteresis curves. The arrangement is shown in Fig. 3. The procedure is as follows: The resistance R_2 is first short-circuited and the switch S is closed. After reversal of switch U the current is regulated by means of resistance R_1, and the current is commutated several times. The switch U is turned downward, the switch S is opened, and the resistance R_2 is adjusted. The switch U is then turned again, but only to such a position that the resistance R_2 is connected in parallel to the magnetizing winding W and the current in the latter decreases while the ballistic galvanometer connected to Z shows a decrease of the induction. The switch U is then again turned downward. Before the next reading is taken the resistance R_2 is decreased, and this is repeated until short-circuit. The switch S is then closed and the resistance R_2 is increased. The switch U is then turned again so that the connection with k_3 and k_4 is broken. Thereby the current is reversed in direction and becomes smaller because the resistances R_1 and R_2 are connected in series. The chief advantage of the method is that the original conditions are reproduced before each reading so that they can be controlled. Each point of the curve is determined independent of the others, and errors in reading are not added together as in the older usual method.—*Archiv f. Elek.*, Vol. 2, page 339; abstracted in *Elek, Zeit.*, July 22, 1915.

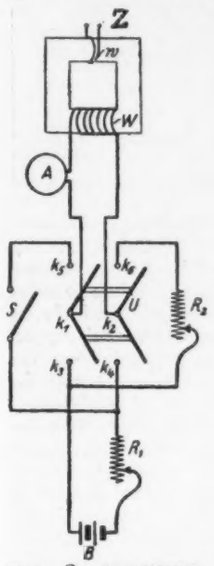


FIG. 3—PLOTTING OF HYSTERESIS CURVES

Designs of Choking Coils.—ARLE YTTERBERG.—A mathematical article giving a new method for determining the design of choking coils so as to reduce the cost to a minimum. The author arrives at the following general results: Very large choking coils should be built without iron; medium-size choking coils should be built of special alloy steel and provided with an air-gap; small choking coils should be built of special alloy steel but without an air-gap; very small choking coils may be built of ordinary iron or electrolytic iron and should have no air-gap.—*Elek. Zeit.*, June 24 and July 1, 1915.

Marking Scales of Instruments.—An article describing the older and usual method for scale-marking indicating instruments and then describing a new method in which a machine is used which can be handled by unskilled labor and gives better results.—London *Elec. Review*, Sept. 24, 1915.

Telegraphy, Telephony and Signals

New Type of Loaded Telephone Line.—BELA GATI.—An article on the improvement of telephone transmission lines by means of induction coils shunted across the line together with condensers.—*Journal Télégraphique*, Feb. 25, March 25, and April 25, 1915; abstracted in *La Revue Elec.*, June 18, 1915 (published Sept. 3, 1915).

Miscellaneous

Alloy Steels.—GEORGE L. NORRIS.—A paper giving the composition and properties of typical commercial manganese steels, silicon steels, chromium steels, nickel-chromium steels, vanadium steels, tungsten steels and complex alloy steels.—*Met. and Chem. Eng'ing*, Oct. 15, 1915.

Vulcanized Fiber.—CHARLES ALMY, JR.—An illustrated article on the physical and chemical properties of vulcanized fiber, which is used in all kinds of electric insulation.—*Met. and Chem. Eng'ing*, Oct. 15, 1915.

South Africa—Statistical tables of the imports of electrical and other goods into South Africa in 1914 from different countries.—London *Elec. Review*, Oct. 1, 1915.

Russian Electrical Industry.—In spite of the war, and partly on account of it, most Russian enterprises for electrical branches have achieved favorable results. The Russian General Electric Company (capital 12,000,000 rubles), an offshoot of the German Allgemeine Elektricitäts Gesellschaft, made a net profit of 2,051,651 rubles in 1914, against 1,751,474 rubles in 1913. The shareholders received 10 per cent as dividend. The Russian Siemens & Schuckert company (capital 15,000,000 rubles) distributed a dividend of 5 per cent for 1914, and the Russian Siemens & Halske company (capital 5,600,000 rubles) 6 per cent, against 5 per cent in 1913. All three companies are now under Russian state supervision, the capital being mostly in German hands. The Russian cable factories have done even better.—London *Electrician*, Oct. 8, 1915.

Book Review

TEST METHODS FOR STEAM-POWER PLANTS. By Edward H. Tenney. New York: D. Van Nostrand Company. 224 pages, 85 illus. Price, $2.50.

This is one of a few books written primarily for the power-station engineer that tell not only what he should do to keep generation costs down but also how this can be done. The author has gone a step further and in many cases explained with what physical means or devices the results aimed at can be secured. In the introduction to the work six principles of economical generation of energy in a steam station are laid down: (1) The use of such fuel as will give the greatest return in heat units for each dollar of its cost; (2) the assurance of continued and uniform supply of the desired grade of fuel; (3) such operation of furnaces as to approach most nearly complete combustion of the fuel; (4) such arrangement of furnaces with respect to boilers as shall permit the absorption by the boiler of the greatest possible percentage of the heat liberated in the combustion of the fuel; (5) freedom of the metal of the boiler from scale on its wet side and soot and slag on its dry side; (6) the production of the maximum horsepower from each pound of steam delivered from the boilers to the generators. It is needless to say that a book with these practical principles as the foundation on which it was conceived should be in the hands of every station operator. The reviewer is impressed with this work because it presents methods, directions and precautions on any test arranged for handy reference. The 224 pages of the book are divided into six chapters, each adequately treating a particular subject. These subjects include purchase and testing of coal, investigation of the economy of combustion, treating and testing boiler-feed water, evaporative tests for capacity and efficiency, prime-mover tests, and testing of power-plant lubricants. Another useful idea is carried out throughout the book at the end of chapters, namely, the listing of articles and standard works on the subjects discussed. This enables the operator who desires to make a study of any plant problem to find readily authoritative reference texts.

W. R. HERSTEIN

W. R. Herstein, whose address before the recent Jovian convention, entitled "The Place of the Middleman—the Jobber," is abstracted at length on page 1036 of this issue, is himself a leading electrical jobber of the South, and is the treasurer and general manager of the Electric Supply Company of Memphis, Tenn. Mr. Herstein at one time studied law and was admitted to the bar, but in 1904 he joined the staff of his present company as bookkeeper. A year later he was appointed secretary and treasurer, and in 1906 he assumed entire management of the business. He prepared and promoted the enactment of the Tennessee contractors' license law and is now president of the Tennessee board of electrical examiners. Mr. Herstein has also been active in the work of the Jovian Order, the Jobbers' association, the Arkansas Association of Utility Operators, etc.

J. H. Risser has been appointed manager of the central-station department of the Globe Stove & Range Company of Kokomo, Ind. Mr. Risser's headquarters are at 731 Edison Building, Chicago.

W. Treadwell Augur, who formerly acted as commercial manager for the Federal Power & Light Company in Ohio, is serving at present as the superintendent of the company's plant at Urbana, Ohio.

A. J. Purinton, who was formerly manager of the East St. Louis (Ill.) Light & Power Company, has accepted a position as general superintendent of the Atlantic City & Shore Railroad Company at Atlantic City, N. J.

Thomas F. Glennon has been appointed a member of the board of directors of the New Bedford (Conn.) Gas & Electric Light Company, to succeed the late George R. Stetson, whose death was recorded in these columns some time ago.

William G. Mack, formerly of Jefferson, Wis., has been appointed manager of the municipal electric-light plant at Norwalk, Ohio. Mr. Mack, who is a native of Norwalk, won first place in the local civil-service examination for the position of superintendent of the new Norwalk municipal lighting plant.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Dr. Charles P. Steinmetz was on Nov. 2 elected president of the Common Council of the city of Schenectady, N. Y., on the ticket of the local socialistic party.

Ray Palmer, former commissioner of electricity for the city of Chicago, has been appointed vice-president and general manager of the New York & Queens Electric Light & Power Company, with headquarters at Long Island City, N. Y.

Prof. Vladimir Karapetoff, author of the article on "Trigonometric Expressions for Phenomena in Long-Distance Transmission Lines," published in the Electrical World of Oct. 16 and 23, is professor of electrical engineering in Cornell University, Ithaca, N. Y. Professor Karapetoff was born in St. Petersburg, Russia, in 1876, and after preliminary schooling received the degree of civil engineer from the Imperial Institute of Ways of Communication, St. Petersburg, in 1897. Two years later he studied electrical engineering in Darmstadt, Germany. After serving as instructor in electrical engineering in several institutions in St. Petersburg, Professor Karapetoff came to America. In 1904 he was made assistant professor of experimental electrical engineering in Cornell University and later professor in that department. He is the author of a number of books on electrical engineering and engineering mathematics, among the number volumes entitled "The Electric Circuit," "The Magnetic Circuit," "Engineering Applications of Higher Mathematics," etc. In addition to his scientific accomplishments Professor Karapetoff is recognized as a broad thinker along sociological lines and as a master of the theory and technique of the musical art.

VLADIMIR KARAPETOFF

LAWRENCE ADDICKS

Lawrence Addicks, the president of the American Electrochemical Society, and who, as one of its nominees, was appointed by Secretary Daniels to serve on the Naval Advisory Board, is an authority on the metallurgy of copper. Mr. Addicks was graduated from the mechanical and electrical courses at the Massachusetts Institute of Technology in 1899. Immediately thereafter he went to New Mexico, where he entered copper-mining work. In 1900, returning East, he assumed the duties of superintendent at the Raritan (N. J.) Copper Works. In 1905 he became chief engineer and a few months later was appointed general superintendent of the United States Metals Refining Company, Chrome, N. Y. In 1914 he was engaged by Phelps, Dodge & Company to conduct large-scale leaching tests on low-grade copper ore at Douglass, Ariz., experiments which have attracted wide interest in metallurgical circles. Mr. Addicks is now in consulting engineering work in New York City.

Obituary

Sylvester C. Dunham, president of the Hartford (Conn.) Electric Light Company, died at his residence in Hartford Oct. 26, at the age of sixty-nine. For the last thirty years he had been active in financial and insurance circles, serving as president of the Travelers' Insurance Company of Hartford since 1901. He succeeded his brother, Austin C. Dunham of Hartford, upon the latter's retirement from the presidency of the Hartford Electric Light Company in 1912.

Isaac L. Rice, president of the Electric Boat Company and for years a leading figure in the storage-battery and electric-vehicle fields, died at New York, Nov. 2, at the age of sixty-five. A lawyer by profession, Mr. Rice early entered upon executive work and for years served as president of the Electric Storage Battery Company, and later was president of the old Electric Vehicle Company. Mr. Rice was also interested in the Car Lighting & Power Company, the Electric Launch Company, the Consolidated Railway Electric Lighting & Equipment Company, and the American Casein Company.

New Apparatus and Appliances

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Industry

Recent Improvements in Single-Phase Rotary Converters

BY VAL. A. FYNN

Single-phase converters have not been much used in the past, mainly because it was found well-nigh impossible, or at least very difficult, to start them from the alternating-current side, and also because of serious commutating difficulties and low weight efficiency. The use of a short-circuited damping winding in connection with field structures, as heretofore employed, certainly improved the commutation and the efficiency to a great extent, but failed to solve satisfactorily the commutation problem and greatly increased the already great starting difficulties.

In 1905 the author made an effort to overcome these difficulties, and he finally evolved the machine about to be described. This new rotary converter can be started from the alternating-current side with a large torque per ampere, commutates perfectly in normal operation, and has a good efficiency and high power-factor. Its main distinctive feature is the arrangement of the damping winding. In one connection this can be used for starting the machine from the alternating-current side, in another for improving the commutation and efficiency in normal operation. To this end the short-circuited damping winding is arranged just like a polyphase winding; the several phases are placed in a certain space relation to the brush line, and provision is made for interrupting the short-circuit of at least one of the phases at starting. The field structure, or stationary part, of these converters is made without defined polar projections.

While this machine was designed mainly for the purpose of converting single-phase into unidirectional current, it can be used for the converse process, and is sometimes used as a synchronous single-phase motor.

When employed for converting alternating into direct current, it enables single-phase currents to be utilized for charging storage batteries or for operating direct-current arc lamps, for instance, in moving picture shows or for any kind of electrolytic work.

Operated as a single-phase synchronous motor, it is particularly useful in connection with revolving rectifying apparatus.

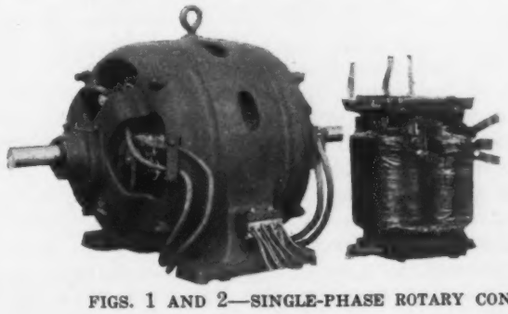
These machines have often been put to a double use in automobile garages sheltering electrically operated vehicles, being employed to charge the storage batteries of the vehicles at night and to drive various auxiliary appliances, like machine tools, pumps, vacuum cleaners and buffing wheels, during the day.

The Wagner Electric Manufacturing Company of St. Louis has acquired the control of the various United States patents covering this converter and has for some time past been regularly manufacturing these machines in different sizes. The photographs and diagrams illustrate the machine and its characteristics.

Referring more particularly to Figs. 3 and 5, which diagrammatically represent a two-pole converter, the machine consists of a rotor carrying a winding 10 connected at one end to a commutator (clearly seen in Fig. 2, but not shown in Figs. 3 and 5) and at the other to a couple of slip-rings 13, 14. In Figs. 3 and 5 the brushes 11, 12, which in practice co-operate with a commutator, are shown as resting on the winding 10 itself, thus eliminating all questions as to how the commutator is connected to the winding. The slip-rings can be connected with external circuits by means of the brushes 15, 16. The stator, which has no defined polar projections, carries a three-phase winding, 5, 6, 7, two phases of which are permanently short-circuited, whereas the third may be either short-circuited or connected in series with the commutator brushes 11, 12. That phase 5 of the polyphase stator winding which is not permanently short-circuited is concentrically disposed with the stator winding 8, which is permanently connected to the commutator brushes 11, 12 and displaced therefrom by 90 electrical degrees. This winding 8 is a shunt winding and produces the unidirectional magnetization when the converter runs at a synchronous speed. The number of rotor conductors being determined by the direct-current voltage required at the commutator brushes 11, 12, and this voltage being as a rule low, it is usually necessary to provide a reducing transformer 21 between the alternating-current mains 2, 3 and the slip-rings 13, 14. The primary 19 of this transformer is generally provided with a tap 4, used at starting, and the secondary 20 has a number of taps 22 for the purpose of varying the direct-current voltage.

At starting (see Fig. 3) brush 11 is directly connected to the alternating-current main 3. The phase 5 of the polyphase stator winding is not short-circuited, but one of its ends is connected to the tap 4 of the transformer and the other to the commutator brush 12 by way of the conductor 9. The shunt winding 8 is connected to the commutator brushes 11, 12. The machine starts as an inductively neutralized, single-phase series induction motor. The phases 6, 7 of the three-phase stator winding do duty as neutralizing winding, producing a magnetization in line with the commutator brushes 11, 12. The third phase 5 does duty as field winding.

The circuit of the shunt winding 8 may remain open at starting, but is often kept permanently closed for its own protection and for the purpose of simplifying the switching operations, although it is well understood that the presence of this short-circuit in the axis of the winding 5 does reduce the torque per ampere at starting. In order to reduce the deleterious effect of this short-circuit, an impedance 23, having a low ohmic resistance and a high reactance, is placed in circuit with the winding 8. This impedance greatly reduces the current induced in 8 at starting, but hardly affects the magni-



FIGS. 1 AND 2—SINGLE-PHASE ROTARY CONVERTER—ASSEMBLED AND DISMANTLED TO SHOW PARTS

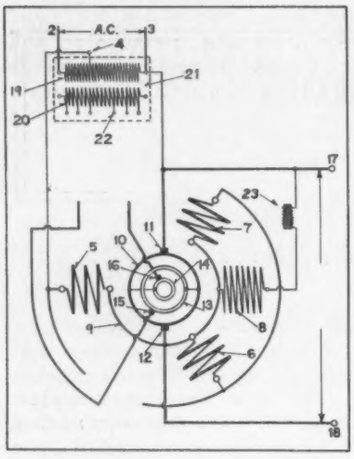


FIG. 3—STARTING CONNECTIONS.

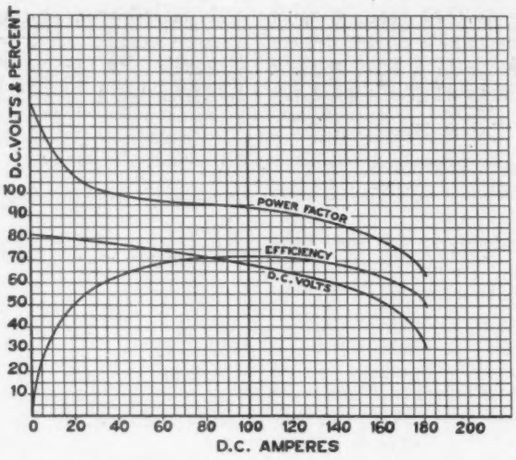


FIG. 4—PERFORMANCE WITH REDUCING TRANSFORMER.

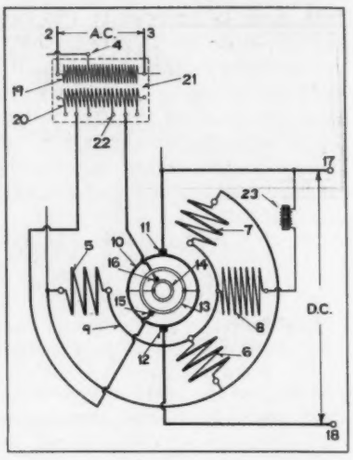


FIG. 5—RUNNING CONNECTIONS

tude of the unidirectional exciting current circulating in said winding at synchronism.

After the machine has reached a nearly synchronous speed the converter is disconnected from the primary 19 of the transformer, the slip-rings 13, 14 are connected to the secondary thereof, and the stator winding 5 is short-circuited, as shown in Fig. 5. Under these conditions, direct current can be derived from the terminals 17, 18 of the machine, and the latter will also operate as a synchronous motor. A change of the voltage impressed on the slip-rings produces a corresponding change of the direct-current voltage generated at the commutator brushes 11, 12.

The three-phase winding 5, 6, 7 serves the double purpose of enabling the machine to be easily started from the alternating-current side and of suppressing the double-frequency magnetization produced by the rotor in normal operation and which is so detrimental to the performance of the machine in general, and particularly to its commutation.

The test results indicated in Fig. 4 have been obtained from a machine and transformer designed to give a drooping voltage characteristic. It is seen that the converter operates with leading power-factor at light loads and with nearly unity power-factor at full load. The efficiency curve is high throughout, and the commutation is perfect at all loads. In this size the stator iron has been cut away just above the coils undergoing commutation, in order to reduce the reactance voltage, which is further lowered by placing heavy copper short-circuits immediately above said coils.

It should be noted that the curves shown in Fig. 4 include the transformer as well as the converter losses. Measured at the terminals of the converter itself, the power factor is from 3 to 6 per cent and the efficiency some 4 per cent higher.

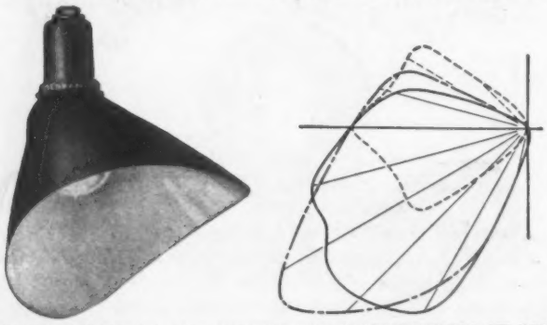
With the winding 8 on open circuit, the machine takes 50 amp at starting and runs up to speed in four seconds. With the winding 8 permanently connected to the commutator brushes and an impedance 23 in circuit with said winding, the machine takes 90 amp. at starting and runs up to speed in six to twelve seconds, according to the reactance value of the impedance.

The temperature rise under full load conditions does not exceed 22 deg. C. for the stator iron, 30 deg. C. for the stator copper, 37 deg. C. for the commutator, and 34 deg. C. for the rotor copper. It is therefore well within permissible limits. As a matter of fact, this same frame is able to yield a 20 per cent higher output continuously when designed for close voltage regulation. In this case efficiency is further increased about 5 per cent.

While the machine illustrated in the figures is started as an inductively neutralized single-phase series motor, it will at once be apparent that the arrangement of the stator windings permits of a number of other starting connections which will yield very satisfactory results. The machine can, for instance, be started as an inductively neutralized series motor with rotor excitation, in which case the permanently short-circuited stator phases should magnetize along an axis displaced from the brush line, and provision be made for opening the circuit of the remaining stator phase only at starting. This converter may also be readily started as a self-excited single-phase series induction motor with rotor excitation, or as a self-excited single-phase series induction motor, or even as a single-phase shunt motor with or without neutralization.

Elliptical-Angle Reflectors

The Benjamin Electric Manufacturing Company of 128 South Sangamon Street, Chicago, has developed a line of elliptical-angle reflectors which produce an even distribution of light from an angular position over vertical and horizontal areas. Reference to the diagram herewith and to its accompanying key shows what illumination results may be expected from this porcelain unit. The maximum illumination occurs at the 35 deg. vertical and 40 deg. horizontal angles—not directly in front of the reflector but at one side. These reflectors, which are of the ventilated type, are said to be particularly applicable to the lighting of large outdoor areas.



ANGLE REFLECTOR AND RESULTING DISTRIBUTION OF LIGHT

Reflector for 200-Watt Gas-Filled Lamps

A new No. 575 silvered-mirror reflector, as it is called, has been developed by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill., for use with 200-watt gas-filled tungsten lamps. It is of the beehive type, and, according to the manufacturer, gives a broad distribution of light and effectively conceals the lamp from direct view along the ordinary line of vision. The dual system of corrugations shown in the accompanying illustration is said effectively to break up the light from the concentrated filament of the 200-watt lamp, eliminating images of the filament, streaks and stria in the illuminated field. The reflector may be also employed with 150-watt

vacuum tungsten lamps, as the light distribution of this lamp is practically the same as that secured with the 200-watt lamp, except that the candle-power values are correspondingly lower. It is claimed that with a reflector of the type shown the 200-watt gas-filled lamp gives general lighting of ample intensity for ordinary manufacturing operations in a 20-ft. by 20-ft. bay or unit area, this meaning that good lighting is obtainable with an energy consumption of 0.5 watt per square foot. The reflector described is the first of a line of industrial lighting reflectors for all sizes of gas-filled lamps which the National X-Ray Reflector Company contemplates placing on the market in the near future.

Day-and-Night Electric Carriage-Call System

An electric carriage annunciator for both day-and-night service, which operates on an ordinary low-voltage battery-operated bell circuit or a circuit fed from a small motor-generator set, has recently been brought

FIG. 1—PUSH-BUTTON CONTROL SYSTEM

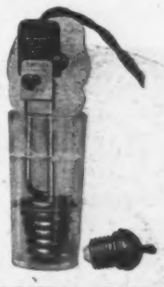
out by the H. W. Johns-Manville Company, Forty-first Street and Madison Avenue, New York. The call system is operated by push-buttons in a cabinet which is shown in Fig. 1 with the door open. Pressure of a control button operates a magnetic catch, releasing an aluminum plate bearing a character corresponding to the button pressed. This operation is repeated through hundreds, tens and units to obtain a desired combination. To restore the device to the blank position the reset button is pressed, releasing an auto-starting switch which sets a ⅛-hp. motor in operation. The

FIG. 2—FRONT VIEW OF ANNUNCIATOR WITH COLOR SIGNALS

system is so designed that it is possible to operate two or more calls from one control station. The normal capacity of the call system is 155 combinations or signals. This may be readily increased by means of colored signals, the addition of a single color serving to double the capacity 100 per cent. Colored signal lamps may also be used to indicate at what entrance a carriage is desired. The case of the calling device is of galvanized iron and glass, is entirely waterproof, and can be readily mounted on a marquis, pedestal or wall bracket. By means of the telltale lamps the operator is always able to verify the numbers and to make certain that they have been correctly shown.

Electric Immersion Heater

For heating small quantities of water quickly in a glass or any other suitable vessel the Simplex Electric Heating Company, Cambridge, Mass., has just brought out the "Quick-Hot" immersion heater shown in the accompanying illustration. The heater is designated by the maker as the No. 479 type and consists of a nickel-plated copper tube in the form of a coil which will readily fit in almost any small vessel. The coil construction has the advantage of a large radiating surface so that

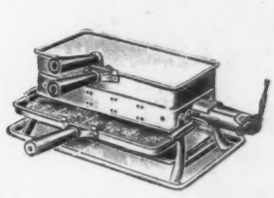


SMALL ELECTRIC WATER HEATER

the heat is evenly and widely distributed instead of being confined to a small limited area. As a result, the device does not become overheated, it is declared, and is assured of long life and freedom from deterioration. The heater is equipped with an insulating disk which prevents it from coming in contact with and doing damage to a table or any other surface upon which it might be placed when the circuit is closed. A small handle which is always cool is provided so that the immersion heater can be handled while it is still hot. The device may be easily cleaned and will withstand long and hard usage. Use is made of the Simplex quickly detachable connector, which can be attached or easily removed with one hand. A 6-ft. cord and Hubbell plug are provided so that it can be attached to any lamp socket. The heater is rated at 360 watts.

Electric Grill and Electric Oven

Two types of electric heating devices recently developed by the Rochester Stamping Company of Rochester,



FIGS. 1 AND 2—ELECTRIC GRILL AND SMALL ELECTRICALLY HEATED OVEN

N. Y., are the electric grill shown in Fig. 1 and the electric oven illustrated in Fig. 2. With the toasters heat is available almost from the moment the circuit is closed, the manufacturer claims, and the circuit may be opened the instant the device is not needed. An entire small meal may be prepared on the grill, it is stated, using both the top and the bottom at the same time.

On account of the open construction, the device can be easily cleaned and the element may be readily removed and crumbs or other waste washed off the plate. The oven is provided with three-heat control with indicating snap switch and can be attached to any convenient lighting socket. It is of medium size and will bake bread, pies, cake, cookies, roast meat, etc. It is built with double walls with a 1-in. insulating air chamber. When heated it will retain its heat for a long time and will act practically as a fireless cooker. With high heat the rating is 600 watts, with medium heat 300 watts, and with low heat 150 watts.

Small Direct-Current Ammeters and Voltmeters

Small "Junior Imp" direct-current ammeters and voltmeters, as they are called, have recently been developed by the Roller-Smith Company, 203 Broadway, New York, for use with battery-charging outfits, small switchboards and similar apparatus. The mechanism

FIG. 1—FLUSH-TYPE AMMETER

is of the permanent-magnet moving-coil type, insuring, it is declared, uniform scale divisions and dead-beat indications. The magnets are of forged tungsten steel. Use is made of a light moving element which, the manufacturer points out, is rigid. A heavy brass case with black rubberoid finish which is dust-proof and moisture-proof is employed. The dials are of etched

FIG. 2—BASE-FLANGE-TYPE VOLTMETER

metal and are black. Connections are in the form of heavy studs projecting from the rear and are provided with suitable nuts and washers. The over-all diameter of each instrument is 3.5 in. and of the body 2.625 in. Ammeters with ranges greater than 40 amp. are provided with separate shunts and 3-ft. leads. Voltmeters with ranges greater than 50 volts are provided with external resistors. In Fig. 2 is shown a base-flange type of instrument which is generally employed. The flush-type ammeter shown in Fig. 1 is designed for special work.

Factory Sewing-Machine Motor

A motor designed for operating heavy sewing machines used in clothing shops, department stores and awning and sail factories has been developed by the Westinghouse Electric & Manufacturing Company,

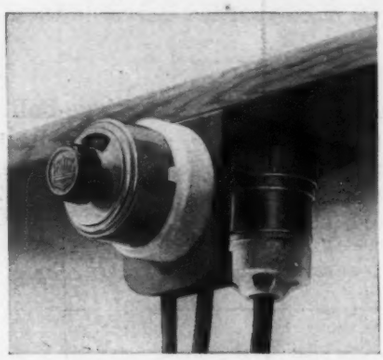


FIG. 1—SWITCH FOR STARTING AND STOPPING MACHINE

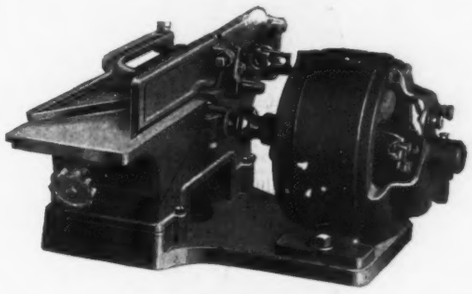
East Pittsburgh, Pa. The machine is a modification of its type CA alternating-current and type CD direct-current motors. The motor is very quiet in operation, it is asserted, and requires practically no attention. It is designed for application to any make of sewing machine. To start the sewing machine, a free-running pulley belted to the hand wheel of the machine is driven by a clutch operated from the sewing-machine treadle, and to stop it a brake is applied as the clutch

FIG. 2—MOTOR FOR OPERATING HEAVY SEWING MACHINES

is released. Complete range of control is obtained by a slight movement of the treadle. The needle is under the control of the operator at all times, and it can be moved so that a single stitch can be made if desired. The outfits are made in two styles, one for alternating-current, the other for direct-current circuits. Fig. 2 shows a switch for starting and stopping the motor.

Electric Bench Jointer

A small 4-in. electric jointer has recently been developed to perform such jobs as are ordinarily done by hand with a plane and square. The machine is equipped with a round safety head, a tilting bench for level work, an automatic guard, and a rear table for rabbeting. The jointer and motor are directly connected and are mounted on a common sub-base. The



MOTOR-DRIVEN JOINTER

knives are 4 in. long and the over-all dimensions of the machine are 20 in. by 18 in. by 9 in. The net weight is 90 lb. In one operation the machine will do the same work, it is declared, that requires a number of operations when done with a plane and square. The motor is rated at 0.25 hp. and is being manufactured by the Robbins & Myers Company, Springfield, Ohio. The jointer is the product of the Crescent Machine Company, Leetonia, Ohio.

Electric Control for Doors

The Mechanical Products Company, Inc., 2016 People's Gas Building, Chicago, has developed the electric door opener and closer shown herewith. The device consists of a small General Electric motor, a push-button

FIG. 1—MOTOR-DRIVEN DOOR OPENER INSTALLED IN A GARAGE

control system, a limit switch and a set of rope-driven sheaves. When the apparatus is installed for operation the motor and the contactor panel of the control system are mounted on the ceiling near the door and a continuous rope is run around a grooved pulley which is geared to the motor. A three-button control panel for opening, closing or stopping the door may be placed at any desired point. In opening or closing the door it is not necessary for the operator to stop the door at the end of its arc of travel, since this operation is performed by an automatic limit switch. The manufac-

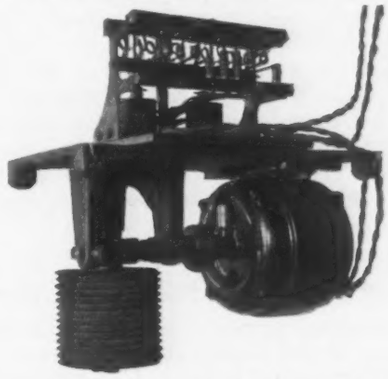


FIG. 2—DETAILED VIEW OF MOTOR AND CONTACTOR EQUIPMENT

turer states that the greatest field of usefulness of this device is to be found in packing houses, where it will displace employees whose only duty is to operate storage-room doors.

Adjustable Pole-Hole Digger

An adjustable tool for digging post holes is shown in the accompanying illustrations. It consists essentially of a straight, strong wooden handle, a shank or ferrule, one leaf-spring, and a steel blade similar to that of an ordinary spade but cupped properly for digging purposes. A case-hardened eye is attached to the blade at the upper end and is so constructed that it has three flat surfaces for the pressure of the spring which rests in the ferrule and bears upon the eye. The blade can be held rigidly in any one of three positions: First, in a perpendicular position for cutting the dirt loose, as shown in Fig. 1; second, in the position of a right angle for removing the dirt from the hole, as illustrated in Fig. 2; third, at an acute angle for refilling purposes or for use as a ditching tool, as shown in Fig. 3. The upper part of the ferrule is cylindrical in shape to take

FIGS. 1, 2 AND 3—ADJUSTABLE POST-HOLE DIGGER IN THREE POSITIONS FOR DIGGING, REMOVING DIRT, AND AS A DITCHING TOOL

the wooden handle and is flattened below to accommodate the spring and fit into a slot made in the blade for its reception, as shown in Figs. 2 and 3. The end of the ferrule is attached to the eye and so arranged that while the tool is in the position of a right angle the back of the ferrule and upper end of the shovel are flush with each other, as shown in Fig. 2. Close to the

upper end of the spring the ferrule is pierced by a set screw which comes in contact with the spring and is used to give the desired tension according to the kind of digging. The tool may be employed as a spade for the first foot or two and then can be utilized to loosen the dirt by chopping. After a sufficient amount is ready for removal the digger is placed in the hole at the side next to the operator and the dirt is pushed toward the opposite side, and the tool is then tripped. The operation of tripping serves to shove the blade under the dirt ready for removal with no chance for its falling back. The post-hole digger is being placed on the market by the Triple Tool Company, Jacksonville, Ill.

Fiber Lining for Metallic Sockets and Receptacles

Linings composed largely of asbestos fiber and a special binder for Mogul sockets and receptacles which are used with nitrogen-filled lamps of high rating are being made by the Elastoid Fibre Company, Waltham, Mass. In the progress of manufacture the material is treated at a temperature varying from 600 deg. to 700 deg. Fahr. The material will therefore withstand a heat, the manufacturer points out, at which the metallic parts of the socket begin to discolor and deteriorate, enduring, accordingly, without injury any heat developed by the largest nitrogen-filled lamps. Tests show that the linings are reasonably uniform in thickness and diameter, are chemically neutral, have good dielectric strength, are absorptive of moisture to about the same degree as ordinary fiber linings, and are practicably non-combustible.

Electric Equipment for Painting Without a Brush

New and improved accessories have been developed by the Paasche Air Brush Company, Madison Terminal Building, Chicago, Ill., for use with its apparatus employed in producing finishes of enamel, varnish, shellac, bronze, mica, celluloid or other liquid materials. The equipment consists essentially of a finishing hood or

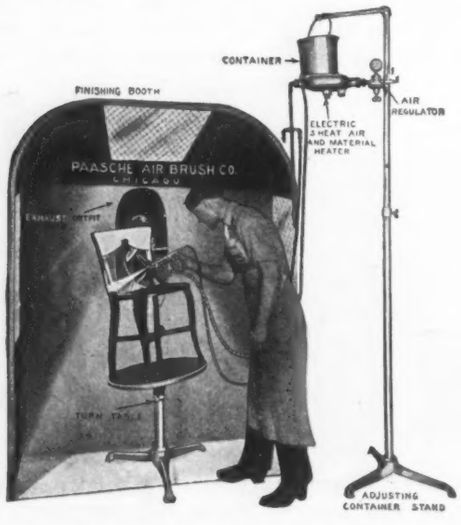


FIG. 1—COMPLETE OUTFIT FOR FINISHING CHAIRS

booth, a motor-driven exhaust outfit, a liquid container, an electric three-heat air and material heater, an air regulator, and a turntable on which the object to be finished is placed. In Fig. 1 is shown a 6-ft. outfit which is used extensively by chair and metal-goods manufacturers. The apparatus is being made in the single-unit type, as shown in Fig. 1, and in the twin-unit type where two hoods are placed opposite to each other and connected to one exhaust outfit which is placed between them. The single units are being made with 4-ft., 5-ft., 6-ft., 8-ft. and 10-ft. finishing hoods. A similar range of sizes is also provided with the twin-unit outfits. The hoods are of galvanized sheet metal, rigidly braced with angle iron. All the types are 7 ft. high. A metal floor

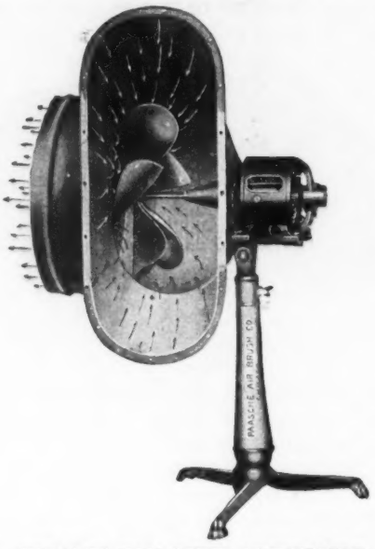


FIG. 2—EXHAUST FAN WITH ADJUSTABLE STAND

is also provided with the outfit. Wired glass is employed for both the sides and the top, permitting ample light for the operator. In Fig. 2 is shown the motor-driven exhaust outfit. The motor is entirely separate from the exhaust, thus preventing paint, varnish or enamel from getting into the motor or any of its working parts. The propeller blades are of a special design and are of aluminum. Adjustable stands are provided which are made in three sizes—an 18-in. stand being used for the

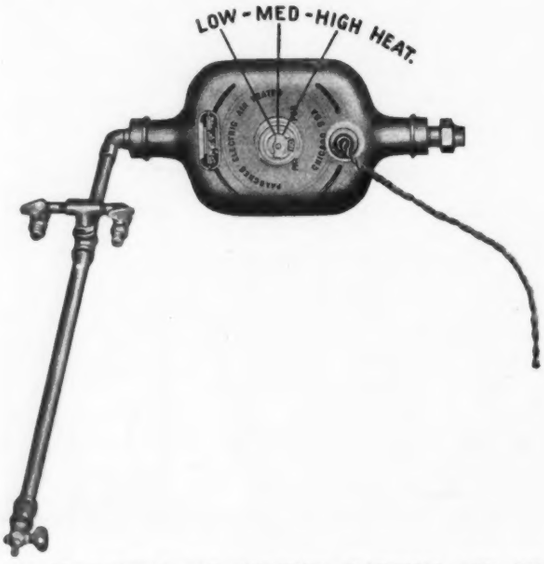
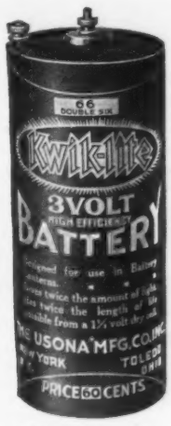


FIG. 3—THREE-HEAT COMBINED MATERIAL AND AIR HEATER

4-ft. and 5-ft. booths, a 20-in. stand for the 6-ft. and 8-ft. booths, and a 24-in. stand for the 8-ft. and 10-ft. booths. The material and air heater is shown in Fig. 3. It is mounted as illustrated in Fig. 1 and is designed to deliver sufficient heat so that material can be applied at a temperature of 120 deg. Fahr., or greater if required.

Three-Volt Lantern Battery

The Usona Manufacturing Company of New York City and Toledo, Ohio, has just brought out a 3-volt high-efficiency battery which is designed for use in all battery lanterns employing its standard No. 6 dry bat-

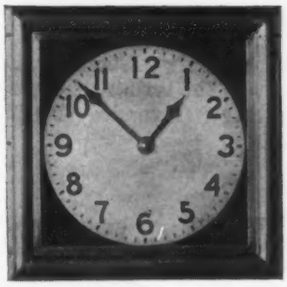


A 3-VOLT BATTERY FOR LANTERNS

tery. The new battery has the same outside dimensions as the No. 6 battery, but has twice the length of life, it is declared, and will give twice the amount of light. The battery is designated as the No. 66 (double-six) unit.

Illuminated Clock Face

"Frink polaralite" signs consist of a heavy sheet of plate glass in which the design is deeply sand-blasted. The source of illumination is entirely hidden, and the



ELECTRICALLY LIGHTED CLOCK FACE

light is reflected up or down edgeways through the glass, giving a very pleasing effect. The same idea has been used in the designing of the clock face shown in the accompanying illustration. The clock can be made to conform to any architectural design and may be provided with or without background. The frame for the clock may be either square, hexagonal or octagonal, employing four lamps, six lamps and eight tubular "linolite" lamps respectively. For use with the square frame the glass is 14 in. or 16 in. in diameter. With the hexagonal and octagonal frames the glass is 22 in. and 36 in. in diameter respectively. The clock is being placed on the market by the H. W. Johns-Manville Company, Forty-first Street and Madison Avenue, New York.

Electric Laundry Iron

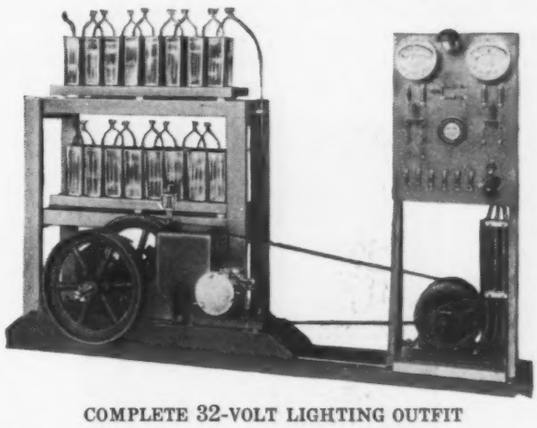
An electrically operated iron designed especially for heavy work, although it may be employed for light work if desired, is shown herewith. According to the manufacturer, the William H. Dalton Company, Salem, Mass., the heating elements are so arranged as to give the most efficient distribution of heat over the ironing surface. The iron is provided with three-heat temperature regulation, actuated by a controller instead of by a rheostat. Five removable plates, each plate weighing 2.5 lb., are provided so that the weight of the iron can be varied

HEAVY LAUNDRY IRON WITH LIFTING DEVICE

from 17.5 lb. to 30 lb. Connections are made at the center of the iron as shown so that the cord is out of reach of the work and will not retard the operator. A lifting device is utilized for easily raising the iron. The iron is double-pointed, permitting of operation in either direction.

32-Volt Gasoline-Engine-Driven Lighting Plant

Small lighting plants for homes, factories, mills, stores, mines, banks, hotels and churches, with ratings of from 450 watts to 1500 watts, are being placed on the market by the Swedish-American Telephone Manufacturing Company, 5235 Ravenswood Avenue, Chicago, Ill. Each plant consists of a gasoline-engine attached to a skid, a 12-ft. leather belt, a storage battery, a switchboard and a shunt-wound generator, all of which



COMPLETE 32-VOLT LIGHTING OUTFIT

are mounted on a heavy angle-iron base, as illustrated. The switchboard is of oiled slate and mounted on a strong angle-iron frame and legs. It is equipped with heavy switches, underload circuit-breaker, self-starting switch, pilot lamp, voltmeter, ammeter and rheostat. In starting the outfit the generator is operated as a motor, taking energy from the battery.

Large-Sized Electric Lantern

In the accompanying illustration is shown a lantern of great size which is one of two recently built for the Linden Company, to be used at the entrance of the new Pullman Memorial Training School, Chicago, by the

ONE OF TWO LARGE LANTERNS FITTED WITH 1000-WATT LAMPS

Beardslee Manufacturing Company, 216 South Jefferson Street, Chicago. Each lantern is 8 ft. high, the diameter of the cap is 4 ft., and the panels are 3 ft. high by 12 in. wide at the top and 9 in. wide at the base. It is made of cast bronze and weighs 500 lb. In the base of the lantern there is a 1000-watt lamp which is set in a specially constructed reflector directing the rays of light from a larger reflector in the hood. By this arrangement it is declared that the objectionable "lamp spot" is eliminated and that a distribution of light is obtained which illuminates each of the panels with the strong, even glow so desirable for out-of-door lighting.

Electric Vibrators for Home Use

Two types of electrically operated vibrators have recently been brought out by the Hamilton-Beach Manufacturing Company, Racine, Wis., particularly for family service or for the use of professional hair-dressers or masseurs who call on patrons at their homes. In Fig. 1 is shown the type without speed regulation. The motor operates on either direct current or alternating current. A switch button in the handle of the vibrator is employed for starting or stopping the motor. The vibrator shown in Fig. 2 is equipped with a speed-regulating

FIG. 1—HOUSEHOLD VIBRATOR WITHOUT SPEED-REGULATING DEVICE

FIG. 2—VIBRATOR WITH SPEED REGULATOR FOR HOME USE

switch. The vibrators are packed in carrying cases of black leatherette, lined with red satin. Five applicators are provided with the vibrator shown in Fig. 1, and six with that illustrated in Fig. 2.

Copper Terminals for Stage Cable and Asbestos-Covered Wires

Stamped copper lugs, designed for use with all-asbestos or rubber-covered wires, leading from rheostats to arc lamps, or wherever there is heat in connection with insulated wiring, have been brought out by the Universal Electric Stage Lighting Company, 240 West Fiftieth Street, New York. The terminals can easily be attached without solder to any stranded or solid wire. Fig. 1

FIGS. 1 AND 2—LUG BEFORE INSTALLATION, AND FIRST OPERATION IN CONNECTING TO WIRE

shows a terminal as it appears in the first stage of installation, the wire ends being passed through the hole in the copper strip between the wing clamps. In the second operation (Fig. 3) the wires are bent back with the insulation between the wing clamps, the clamps then being tightened with pliers or hammer. In Fig. 4 is shown the terminal completely installed, with insulation fastened between the wing clamps and the bare wire fastened underneath between the copper strips.

FIGS. 3 AND 4—SECOND AND LAST OPERATIONS FOR CONNECTING LUG TO WIRE

News of the Industry

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Snap and Knife-Switch Sections Formed by Supply Manufacturers

On Oct. 23 at the Hotel Biltmore, New York, two new sections were formed by the Associated Manufacturers of Electrical Supplies. The meeting in the morning was in the interests of the snap-switch manufacturers and was attended by representatives from the Bryant Electric Company, the Arrow Electric Company, the General Electric Company, the Hart & Hegeman Manufacturing Company, the Perkins Electric Switch Manufacturing Company, the Trumbull Electric Manufacturing Company, the Hart Manufacturing Company, and the Metropolitan Electric Manufacturing Company.

Shiras Morris of the Hart & Hegeman Manufacturing Company, Hartford, Conn., was nominated for chairman, and Frank E. Watts of the Hart Manufacturing Company, New York, and J. C. Dallam of the General Electric Company were elected secretary and treasurer respectively. Rules were adopted, and three committees were appointed, consisting of five members for the flush-switch committee, three members for the surface-switch committee and three members for the pendent-fixture and miscellaneous switch committee, each committee to choose its own chairman.

At the afternoon meeting the knife-switch section was organized, representatives being present from the following companies: The Bryant Electric Company, the Crouse-Hinds Company, the George Cutter Company, the General Electric Company, the H. Krantz Manufacturing Company, the Metropolitan Electric Manufacturing Company, the Perkins Electric Switch Manufacturing Company, the Trumbull Electric Manufacturing Company, and the Westinghouse Electric & Manufacturing Company.

J. H. Trumbull, Plainville, Conn., was elected chairman. T. A. McDowell of the Westinghouse Electric & Manufacturing Company and P. J. Shelley of the Metropolitan Electric Manufacturing Company, Long Island City, were elected secretary and treasurer respectively. This section will have three standing committees covering knife switches, mounted and unmounted, knife switches mounted on porcelain, and disconnected and miscellaneous switches, each committee to consist of five members.

August Electrical Exports

The exports during August, 1915, of electrical goods manufactured in the United States, according to reports from the Bureau of Foreign and Domestic Commerce, were greater by $800,000, or 76 per cent, than the exports during August, 1914. During the first eight months of 1915 the increase in electrical exports amounted to over $1,300,000, or approximately 10 per cent.

The principal gains during the month of August were in batteries, $75,794, or 200 per cent; dynamos or generators, $102,336, or 90 per cent; insulated wire and cable, $199,847, or 400 per cent; metal-filament lamps, $64,527, or 670 per cent, and motors, $159,450, or 135 per cent. For the current year through August the large increases occurred in the shipment of batteries, insulated wire and cable, interior-wiring supplies and metal-filament lamps. The foreign demand for American dynamos and generators, although showing an increase in August, was less by $300,000 for the first eight months of 1915, as compared with the similar period in 1914. To a less extent was the same condition true for motors. Telephone apparatus and transformers continued to show a falling off.

It might be pointed out that the exports of carbon lamps, while they are not so large as those of metal-filament lamps, increased both in August and the first eight months of 1915.

ELECTRICAL EXPORTS FOR AUGUST AND FOR EIGHT-MONTH PERIOD

	August		Eight Months Ended August	
	1915	1914	1915	1914
Electrical machinery, appliances and instruments:				
Batteries	$114,516	$38,722	$864,001	$424,953
Dynamos or generators	216,906	114,570	1,449,523	1,746,665
Fans	15,453	5,528	230,721	253,644
Insulated wire and cable	251,083	51,236	1,764,300	914,372
Interior wiring supplies, etc., including fixtures	49,202	43,511	605,166	401,404
Arc lamps	1,633	1,620	16,845	29,869
Carbon-filament lamps	17,221	4,338	97,423	64,070
Metal-filament lamps	74,119	9,592	420,592	118,629
Meters and other measuring instruments	57,244	23,747	396,237	*55,332
Motors	277,940	118,490	2,044,386	2,147,135
Telegraph instruments (including wireless apparatus)	17,030	3,101	74,683	74,850
Telephones	50,841	78,403	682,859	770,918
Transformers	29,146	33,609	375,291	688,734
All other	633,958	497,543	5,955,413	5,963,994
Totals	$1,806,292	$1,024,010	$14,977,440	$13,654,569

*Figures cover period beginning July 1.

New Tungsten Lamp Prices for New York

In compliance with the order of the Public Service Commission, First District, New York, handed down Oct. 15, the New York Edison Company and the United Electric Light & Power Company have issued a new schedule of prices of incandescent lamps, effective Nov. 1. By the order of the commission, on and after Jan. 1, 1916, the incandescent lamps furnished as renewals under the lamp-service agreement by the New York Edison Company and the United Electric Light & Power Company shall be tungsten lamps of standard efficiencies and ratings or other lamps of like or of greater efficiency and rating, provided that tungsten lamps of 50-watt rating and above are to be furnished free, while the smaller sizes are to be furnished at an extra charge which shall be no more than the additional renewal cost of such smaller lamps. After Jan. 1, 1916, the company has been ordered not to furnish to its customers "Gem" lamps or other lamps of a specific consumption of less than 1.25 watts per candle-power. The renewal and

sales prices of incandescent lamps in plain bulbs are given in the table below. It might be mentioned in this connection that for some time the United Electric Light & Power Company and the New York Edison Company have been furnishing 60-watt lamps and larger ones free to renewal contract customers.

RENEWAL AND SALES PRICES OF INCANDESCENT LAMPS

Type	Rating	Present Sales Prices	New Sales Prices	Present Extra Prices Under Renewal Contract	New Extra Prices Under Renewal Contract
Mazda.....	10-watt	$0.24	$0.22	$0.24	$0.17
	15-watt	0.24	0.22	0.21	0.15
	20-watt	0.24	0.22	0.16	0.12
	25-watt	0.24	0.22	0.14	0.10
	40-watt	0.24	0.22	0.12	0.05
	60-watt	0.32	0.29	Free	Free
	100-watt	0.55	0.52	Free	Free
	150-watt	0.87	0.87	Free	Free
	250-watt	1.42	1.42	Free	Free
	400-watt	2.54	2.54	Free	Free
	500-watt	2.76	2.76	Free	Free
Gem.....	20-30-40-50-watt	0.14	0.14	....	....
	60-watt	0.165	0.165	....	....
Mazda, "C"	100-watt	1.00	1.00	....	....
	200-watt	2.00	2.00	....	....
	300-watt	3.00	3.00	....	....
	400-watt	3.75	3.75	....	....
	500-watt	4.50	4.50	....	....
	750-watt	5.00	5.00	....	....
	1000-watt	6.00	6.00	....	....

Federal Trade Commission Extending Export Inquiry

The Federal Trade Commission announces that it will soon send out 30,000 letters of inquiry, followed up by a brief schedule, as a part of the investigation of conditions that affect American foreign trade. Congress has empowered the commission to make an investigation of these conditions and to report the facts with such recommendations as it deems advisable.

By public hearings throughout the country and by other means the commission has been gathering facts and information as a basis for its report to Congress. It now wishes to obtain information from a large number of men who were unable to appear at the hearings. For this purpose these letters and schedules will be sent out.

About 20,000 letters will go to American manufacturers and producers, and about 10,000 will be sent to other authorities on foreign trade conditions, such as export commission merchants, manufacturers' export agents, importers, domestic merchants, publicists, lawyers, economists, bankers, engineers, etc.

A return post card accompanying the letter is designed to give the commission a broad yes or no referendum on the advisability of export combinations, and to put it in touch with those who are willing to assist it by furnishing further facts and suggestions. To those who state that they will co-operate with the commission in furnishing facts, etc., the schedule of inquiries will be sent, covering the topics on which the commission desires information.

Through this letter of inquiry and schedule the commission particularly desires to get the facts from many different points of view and from all sides of controverted questions. Thus, the 20,000 names of manufacturers and producers include every important branch of American industrial enterprise and represent every shade of opinion in regard to the present problems of our foreign trade. The list takes in big business and little business, companies that are old in exporting and firms that are new, interests that want combinations among American manufacturers for export trade and men who are opposed to such organizations, manufacturers of specialties and producers of staples, concerns whose foreign trade is limited to South America or Europe and those whose products are sold all over the globe.

ENERGY COSTING MORE IN ENGLAND

War Makes It Necessary for Various Municipalities to Increase the Price of Electricity

There has been an almost universal increase in rates for electrical energy in Great Britain since the war. An analysis of the rate increases since the first of last May, as reported in the London *Electrical Review*, reveals ninety-six actual increases in light and motor-service rates and eighteen cases where an increase has been recommended by those in charge of the utilities. Reasons are not always stated, but in thirty-two cases the abnormal rise in the price of coal was responsible for the increase. Seven stations cited large increases in wages, three decreased lighting hours, eight increased cost of materials, one blamed the war, and ten gave various other reasons not specified. Some companies gave as many as five reasons for raising the price of energy.

Most of the increases were in the neighborhood of a farthing to a halfpenny, or, in American currency, from one-half cent to a cent, per kilowatt-hour. Many of the companies expressed the increases in percentage. These were as follows: For lighting, forty-six companies increased rates 10 per cent, nine 12.5 per cent, four 15 per cent, three 7.5 per cent, and two 25 per cent; for motor circuits, thirty-six municipalities boosted the rate 10 per cent, fifteen 15 per cent, ten 12.5 per cent, seven 20 per cent, two 7.5 per cent, and two 25 per cent. There were a few other scattered cases of odd amounts, but none greater than 25 per cent.

In most cases the same percentage increase was made in rates for all uses. In thirteen cases, however, the percentage increases in rates for motor service were greater than those for lighting, and in five cases the reverse was true. Where the motor-service rates were increased by a larger percentage than the lighting rates it was generally noticed that the gross increase was the same. In nine cases the only increase was in rates for motor service.

While the price of coal reached its height during the last week in March and has since come down, it is still considerably above former prices. On Jan. 2, 1915, the pit-head price for the best Newcastle steam coal was 13s. 3d. On March 27 it was £1 10s. It began to fall on May 1, and the price on Oct. 2 was quoted at 18s. 9d. The pit-head prices for the best Yorkshire coal show the same conditions. The price on Jan. 2 was 14s. per ton. On Feb. 27 it was high at £1. It began to decrease on March 27, and on Oct. 2 it was 17s. 3d.

The war has for many reasons caused wages to increase considerably. Many men enlisted and went to the front, and those who remained were tempted by the large wages to be had at factories working on government orders. To retain their employees central stations have found it necessary to pay large wages, to pay war bonuses, and to provide opportunities for their help to earn extra money during the week-end holiday. At the same time other industries have found almost similar conditions and have been forced to make an increase in prices, with the result that materials needed in the central stations have become higher in price. The curtailment of light at night by the government as a precaution against air raids has, it has been estimated, practically halved the income from this source of energy supply.

Legal Notes

Court Decisions and Opinions Bearing on Questions Affecting the Electrical Industry

Employee's Assumption of Risk.—An employee's assumption of all ordinary risks under conditions in respect to which the master has done his duty merely negatives, it was held by the Supreme Court of Oklahoma (151 P. 875), the existence of primary negligence of the master.

Temporary Disability.—In defining temporary disability as distinguished from permanent disability under the workmen's compensation acts, Justice Kalisch of New Jersey (95 A. 143) held the opinion that temporary disability is the condition that exists until the injured employee is as far restored as the permanent character of the injuries he received will permit.

No Damages for Foreman Because of Unsafety of Working Place.—The Supreme Court of South Carolina in the case of Cine versus Southern Railway Company ruled that it is the duty of the foreman to provide a reasonably safe place to work in and that if this is improperly done the master cannot be held for injuries received for that reason by the foreman. A servant cannot hold the master for not doing that which was the servant's duty as the representative of the master to do.

Employer's Liability.—An employer must use reasonable care and diligence to prevent accident or injury to an employee, according to a decision of the Supreme Court of California (151 P. 290), and failure to do so makes him liable for damages resulting to the employee, whether he undertook the performance of such duty personally or delegated it to another; so that where plaintiff's employer had a flagman on duty to warn employees working in a trench his failure to warn an employee of the danger would render the employer liable.

Employers' Liability When Servant Works Outside Regular Employment.—Where an employee gratuitously or without proper authorization undertook to aid in work outside his regular employment, and while so aiding was killed, the Supreme Court of Alabama (695,604) holds that the employer was not liable for his death. Where, however, a boss having control of employees tacitly accepted the service of an employee, though foreign to his regular work, the service was authorized in a legal sense and the employee was within the protection of the law.

Damages for Back-Water.—A hydroelectric company authorized to exercise the right of eminent domain obtained by purchase certain land and erected a dam which caused back-water. An owner of adjacent land brought suit to recover damages, alleging that the work was negligently done, causing stagnant water which produced noxious gases and disease-bearing mosquitoes. The plaintiff claimed that sickness had thus been caused, as well as injury to the property whereon he lived and which was cultivated. Among other items of damages, it was claimed that croppers who cultivated a portion of the plaintiff's place were made sick and moved away, leaving the crops ungathered, and that by reason of sickness the plaintiff could not gather all the crops, so that some were lost or deteriorated in value. It was held by the Supreme Court of Georgia (86 S. E. 324) that such items of damage were too remote and speculative to furnish ground for a recovery on the basis of the value of the crops thus lost.

Rights of Riparian Owners.—In a proceeding to condemn a half interest in a water-power the Supreme Court of North Carolina held (86 S. E. 296) that it was an error to take from the jury the issues as to whether the water-power was capable of being developed for the production of electric power in connection with a power already developed, and whether such water-power was being held to be used and to be developed for use in connection with a power now used by defendant, such facts prohibiting condemnation under the Laws of 1913, Chap. 94. It was further held that where a stream passes between the lands of opposite riparian owners one of such owners cannot build a dam to the middle of the stream and divert half the water through a flume, even though he may return it into the stream before it leaves his land, since in such case each riparian owner is entitled to the whole bulk of the stream, undivided and indivisible.

No Recovery Possible in Rate Discrimination Cases Provided Ordinance Maximum Is not Exceeded.—Federal Judge M. J. Wade has denied the petition of the Homestead Company to recover $15,000 from the Des Moines Electric Company for alleged overcharges on electrical energy. The Homestead Company claimed that competitors were enjoying lower rates. There is a city ordinance in effect which fixes the maximum rates to be charged by the electric company, and it was shown that at no time has the Homestead Company been charged more than the ordinance rate. Judge Wade's opinion holds, first, that the rate fixed by the ordinance must be assumed to be a reasonable rate, and the Homestead Company, not having paid in excess of that rate, cannot recover upon any theory that the rate paid was unreasonable; second, that the reasonableness of the rate, so long as that rate does not exceed the maximum established by the ordinance, cannot be tested at the instance of the individual user of energy; third, that while public service corporations will not be permitted to discriminate in their charges for service made to competitors in business in the same locality, so long as the rate charged does not exceed the ordinance rate no recovery can be had because of such charge.

Release from Liability.—Prior to the construction of its dam a hydroelectric company having the right of eminent domain obtained from the owners of certain lots a deed to portions thereof for the purpose of making a reservoir and backing water by means of its dam. In the deed, after describing the property conveyed and referring to the easements, rights, members and appurtenances appertaining thereto, appeared the following words: "The said party of the second part, its successors and assigns, being hereby released and discharged by the said parties of the first part, their heirs, personal representatives and assigns, from any and all actions and rights of action, rights to or claims for any damages of any nature resulting from the construction, maintenance or operation of said dam or power plant and the consequent changes in the height of the water." It was held by the Supreme Court of Georgia (86 S. E., 322) that such conveyance released the defendant from all damages resulting from the proper and non-negligent construction, maintenance or operation of the dam or power plant, but did not operate as a release of damages resulting from a negligent construction and maintenance thereof.

Fear as an Element of Damages.—A right-of-way 100 ft. wide was condemned for the erection and maintenance of a transmission line, and the jury in assessing the damages considered the fear caused to the public by these lines as a cause of depreciation of the value of the remaining land. The judgment pronounced on the verdict was reversed by the Supreme Court of Alabama (67 S. 833). Justice De Graffenried in his opinion said: "A large percentage of the agencies which now conserve human effort are, when negligently controlled, dangerous to human life, and many things now daily used upon our streets and upon our public highways were when they were first introduced objects of terror to those who knew nothing about them. If it be true that some people who have not grown accustomed to lines similar to that of appellant are afraid of this improvement, and that therefore they are not willing to buy appellee's lands, the law can furnish to appellee no remedy therefor and cannot regard depreciation created by such a cause as resting upon any substantial basis. The law can and will see that appellee is justly compensated for the rights which appellant has acquired in the condemned strip, and if appellee shows on the next trial, by evidence of a substantial quality, that there has been actual resultant damages to the remaining land by reason of the appellant's right-of-way through appellee's land, the law will award him compensation for the resultant loss. In allowing compensation, however, it cannot allow any compensation on account of any claimed depreciation of such remaining land which is due to the mere fears of some of the people, which are founded in reality upon their lack of knowledge of the real effect of the line, and which human experience shows are not justified by the facts."

Associations and Societies

Buffalo Jovians Hold Prosperity Week Meeting.—The Jovian League of Buffalo, N. Y., held a mass meeting of all electrical men in Buffalo on Nov. 4 to discuss plans for "cashing in" during Electrical Prosperity Week.

Cleveland Electrical League.—A meeting of the Cleveland (Ohio) Electrical League was held at the Hollenden Hotel on Oct. 28, when addresses were made by Peter Witt, Harry L. Davis, Charles P. Salen and M. G. Norton.

Annual Meeting of Naval Architects and Marine Engineers.—The twenty-third annual meeting of the Society of Naval Architects and Marine Engineers will be held at the Engineering Societies Building on Nov. 18 and 19. Included among the large number of papers to be presented is one by W. L. R. Emmet on "Some Comparisons Relating to Electric Propulsion of a Battleship."

Boston Edison Company Section, N. E. L. A.—Capt. A. G. Reynolds, chief clerk to the president of the Boston Elevated Railway Company, gave an illustrated lecture on "More Than Half a Century of Street Railroading in Boston" at the annual meeting of the Boston Edison company section of the N. E. L. A. on Oct. 19. The meeting was held at the Massachusetts Avenue service buildings, and the following officers were elected for the ensuing year: President, L. L. Elden; vice-presidents, C. E. Greenwood and H. W. Stevens; secretary, John J. Buckley; treasurer, C. H. Miles.

Prosperity Banquet for Duquesne Light Company Section, N. E. L. A.—Members of the Duquesne Light Company section of the National Electric Light Association held a prosperity banquet in Kaufmann's Auditorium, Pittsburgh, Pa., on Oct. 21. The banquet was preceded by a short business meeting. James D. Callery, president of the company, addressed the members on welfare work. He was followed by Dean C. B. Connelly of the Carnegie Institute of Technology on "Prosperity, the Result of Properly Investing Our Time." Other speakers were R. S. Orr, general manager of the Duquesne Light Company, and J. C. Hobbs, president of the company section.

New York Jovians Learn of Business Psychology.—Before a small but enthusiastic audience at the weekly New York Jovian League luncheon held at the Hotel Martinique on Nov. 3, Charles L. Eidlitz, first president of the National Electrical Contractors' Association, delivered an address on the "Psychology of Business." The topic was discussed from the standpoint of the salesman or seller. "Know your 'prospect's' mind," was Mr. Eidlitz's first axiom. The stereotyped sales talk, learned and delivered in parrot fashion, is valueless in modern business. Every man's mind is different, and for that reason the salesman should study his 'prospect' in advance and approach him in a manner that will assure his whole-hearted attention and interest. In the matter of salesmen's letters, Mr. Eidlitz further emphasized the point of attracting and holding the customer's attention. "Since," he said, "every man on opening a letter must read the first few lines to know whether he shall read further or consign the letter to the waste-paper basket, the first few lines is the place to deliver the 'punch' of the argument." In closing the speaker dwelt on some of the psychological aspects of the buyer's market and the seller's market. Nobody gains in the buyer's market, but in the seller's market not only the seller profits, but also the buyer who has been fair and above-board to the seller in the buyer's market. Instances were cited to show how poorly an unscrupulous buyer in a buyer's market might fare at the hands of the seller in the seller's market. Mr. Eidlitz promised to discuss at a later meeting further the same topic, this time from the standpoint of the buyer. Frank E. Watts, chairman of the speakers' committee of the New York Jovian League, announced some of the plans for future meetings. Mayor Mitchel, District-Attorney Charles A. Perkins, Frank A. Vanderlip, president of the National City Bank of New York, and Dr. Jeremiah Jenks are among those who will address future meetings of the league. Plans are also being perfected to have the members listen to Harry J. Pieper of the Southern California Edison Company talking from Los Angeles over the transcontinental telephone line. Roy E. Schaulin of the business staff of the ELECTRICAL WORLD, the new first tribune of the New York Jovian League, presided at the meeting.

Public Service Commission News

New York Commissions

The Public Service Commission, Second District, New York, has approved the franchises granted by the city of New York to the Yonkers Electric Light & Power Company and the Westchester Lighting Company for the construction of an electric transmission line along the aqueduct lands in the county of Westchester, and a contract whereby these companies and the New York Edison Company and the United Electric Light & Power Company may use the line in return for furnishing the city with electricity which it will need in the operation of the aqueduct. The approval was given after publication of the application in the papers of Westchester County and after a hearing before Commissioner Emmet in New York at which no opposition to the project was recorded. The Yonkers company will do the work in the city of Yonkers and the Westchester Lighting Company in the rest of the county. Electricity will be supplied the line by the Edison and United companies at the New York city line.

Upon an opinion by Commissioner Devoe P. Hodson, and with the assent of the town authorities, the Public Service Commission, Second District, New York, has permitted the People's Natural Gas Company to increase its rates in the town of West Seneca and a small portion of the city of Buffalo from 25 cents to 32 cents per 1000 cu. ft., with a discount of 2 cents per cubic foot on bills paid within ten days. The case possesses special interest because the franchise of the company in West Seneca limited the price it could charge for gas to 25 cents. The company showed, however, that for several years it had not been able to do a profitable or satisfactory business. Judge Hodson, in his opinion, declares the principle that it is the duty of the commission to conserve the interests of the company as to income and benefits quite as much as it is to protect the rights of the public as to rates and service. He says: "Adequate prices which will yield a fair return upon the invested capital of the company, after providing for all such expenditures, are as necessary and proper as the day wages of a laborer or any other just compensation in the economy of business. This proposition is not always recognized by the public, which sometimes makes unreasonable demands upon a public service corporation in order to gain some slight advantage in the matter of rates and service. This course often deprives the utility of a proper current income for the service rendered and usually terminates in loss and inconvenience to all parties concerned." Speaking of the action of the town authorities in waiving the limitations in the franchise against an increase in rates, Commissioner Hodson commends this action as "recognizing the principle that the company and the customers it serves have a mutual interest in the business, and that good service by the company should be properly compensated by the customers in order to make such business remunerative to the company and a benefit to the people of the town, and that, by the same token, a blow at either would work serious injury to the other."

Massachusetts Commission

Following conferences with the Public Service Commission, the New England Telephone & Telegraph Company has agreed to install divided ringing apparatus on four-party lines within the Boston metropolitan district, to conform to standards of similar service now available in other centers in the State. The company desired to eliminate four-party service, but the commission did not sanction this step and has been working since early in the year to put it on a part with similar service in other cities.

On Nov. 8 the commission will hear the petition of the Bay State Street Railway for authority to increase its fares throughout its system of nearly 1000 miles of track. The company's case will first be presented and is considered one of the most important which have come before the board. On the same date the Massachusetts Supreme Court will hear the appeal of the Western Union Telegraph Company against the recent decision of the board ordering the restoration of stock-ticker service to Calvin Foster of Boston. The commission's finding in this case has attracted country-wide attention, in view of its clear discussion of interstate and intrastate quotation transmissions.

Corporate and Financial

American Light & Traction Company, New York, N. Y.—The directors have declared the regular quarterly dividend of 1.5 per cent on the preferred stock, a quarterly cash dividend of 2.5 per cent on the common stock, and a stock dividend of two and one-half shares of common stock for every one hundred shares now held, all payable Nov. 1 to holders of record Oct. 15. Earnings for the twelve months ended Sept. 30 show a gross gain of approximately $600,000. Expenses increased during the year about $8,500. The total surplus earnings were $14,410,872, a gain of about $1,100,000. The surplus balance which remained after deducting dividends was $10,371,970, a gain of $800,000. The comparative statement for the twelve months ended Sept. 30, 1914, and 1915, follows:

	1915	1914
Earnings on stocks of subsidiary companies owned by this company	$4,239,114	$3,661,448
Miscellaneous earnings	745,940	728,635
Gross earnings	$4,985,054	$4,390,083
Expenses	156,620	148,049
Net earnings	$4,828,434	$4,242,034
Surplus and reserve Sept. 30, previous year	9,582,438	9,081,436
Total surplus earnings	$14,410,872	$13,323,470
Dividends	4,038,902	3,741,032
Surplus balance Sept. 30	$10,371,970	$9,582,438

Massachusetts Lighting Companies, Boston, Mass.—Notwithstanding adverse business conditions and nine rate reductions, one in gas and eight in electricity, the trustees of the corporation, according to the annual report for the year ended June 30, 1915, feel that the results of the year have been excellent. More gas and electricity consuming equipment has been installed for customers this year than during any previous year. The consolidated operating account of the companies of which the shares are owned by the Massachusetts Lighting Companies follows:

Gross earnings	$1,333,250
Operating expenses (including taxes)	930,669
Net earnings	$402,581
Non-operating income—net	25,380
Total net income	$427,961
Interest charges	119,541
Balance	$308,420
Dividends paid	306,632
Balance	$1,788

Peerless Truck and Motor Corporation.—For the purpose of taking over the business and properties of the Peerless Motor Car Company, Inc., of Cleveland, Ohio, and the General Vehicle Company of Long Island City, N. Y., the Peerless Truck & Motor Corporation was formed on Nov. 3. Both companies are engaged in manufacturing motor trucks, of both gasoline and electric type, aeroplane motors, and gasoline automobiles, and are exporting many trucks, aeroplane motors and ammunition parts for war purposes. The General Vehicle Company has been very active in the development of the electric truck and is closely affiliated with the General Electric Company. The controlling interest in the Peerless Motor Car Company is also held by interests closely allied with the General Electric Company—H. A. Tremaine and F. S. Terry, managers of the National Electric Lamp Works of the General Electric Company. The officers of the Peerless Motor Car Company are I. H. Kittredge, president; T. W. Frech, vice-president, and H. A. Tremaine, secretary and treasurer. The directors include, in addition to Messrs. Frech and Tremaine, G. B. Siddall, E. H. Parkhurst, B. G. Tremaine, J. R. Crouse, A. B. McNairy, L. H. Treadway and C. E. Sullivan. The authorized capital stock is $5,000,000 7 per cent cumulative preferred and the same amount of common. A total of $4,200,000, equally divided between the two classes of stock, is outstanding. The authorized capital stock of the General Vehicle Company is $10,000,000, half in 7 per cent cumulative preferred and half in common. All the common and $1,200,000 of the preferred are outstanding. P. D. Wagoner is president of the company, and the other officers are G. W. Wesley and F. C. Pratt, vice-presidents; M. F. Westover, secretary, and L. S. Nold, treasurer. The directors are, in addition to Messrs. Wagoner and Pratt, A. W. Burchard, E. A. Carolan, A. K. Baylor, M. F. Westover and W. B. Potter. No announcement has been made of the new officers or capital stock of the new company. The new company will take up at once the manufacture of aeroplane motors on a large scale, owning as it does the American rights of the Daimler Motoreen Gesellschaft of Stuttgart and Berlin.

Virginia Railway & Power Company, Richmond, Va.—The sixth annual report of the company for the year ended June 30, 1915, besides containing a very complete financial statement, has a large number of data relative to equipment. The railway department showed considerable losses in gross revenue owing to jitney competition and business depression. The electric light and power and gas department made a gain of almost $100,000. The expenditures during the fiscal year for additions, extensions and betterments to property and charged to capital account amounted to $336,898. Of this amount $137,570 was charged to the railway department, $176,607 to the light and power department, and $27,721 to the gas department. The cash on hand on June 30 amounted to $489,999, or more than twice that on hand a year previously. The commercial output for the fiscal year was 58,044,703 kw.-hr., as compared with 52,091,214 kw.-hr. the previous year. The number of customers increased from 20,782 to 23,267. The total connected commercial load increased during the fiscal year from 59,776 kw. to 67,588 kw. The gross earnings, income and disbursements of the combined properties owned, leased and operated by the company for the fiscal year, after excluding offsetting transactions between companies and departments, are given below:

	June 30, 1915	June 30, 1914
Gross earnings	$5,109,622	$5,156,048
Operating expenses	2,469,074	2,465,908
Operating revenue over operating expenses	$2,640,548	$2,690,140
Other income	80,919	80,910
Gross income	$2,721,467	$2,771,050
Taxes and licenses	298,551	308,112
Income applicable to fixed charges and rentals	$2,422,916	$2,462,938
Total fixed charges, etc	1,337,867	1,307,348
Surplus over fixed charges and rentals	$1,085,049	$1,155,590
Total direct charges	162,546	183,685
Surplus over fixed and other charges	$922,503	$971,905
Surplus over fixed and other charges applied as follows:		
Dividends on preferred stock	472,752	.....
Dividends on common stock	358,482	.....
Net surplus for the year June 30, 1915, after payment of dividends	$91,269	.....

Worcester (Mass.) Electric Light Company.—The annual report of the company covering the year ended June 30, 1915, showed an increase in the several departments of the company's business. The gross income increased 11.5 per cent and the output was larger than the previous twelve months' period by 1,835,104 kw.-hr., or 5.8 per cent. During the year 1471 hp. in electric motors was added to the connected load, making a total of 17,735 hp. in motors on the company's lines on June 30. There was also an additional 36,253 of 50-watt equivalents in incandescent lamps placed in service. The increase during the year in the energy demand by manufacturing establishments was 8.1 per cent, while the increase in residential lighting was 23.3 per cent. The earnings statement for the year is as follows:

Receipts:	
From light and power	$971,604
Rent of conduits and poles	4,556
From steam heating and elevator service	9,912
From wiring and motors	5,012
Total	$991,084
Expenses:	
At station	219,899
For energy purchased	3,713
For distribution	139,372
For management	70,554
For taxes	70,806
Miscellaneous	19,920
Net income	$466,820
Profit and loss—Credit:	
Balance June 30, 1914	433,211
Interest	2,080
	$902,111
Profit and loss—Debit:	
Dividends	159,000
Interest	11,794
Depreciation	208,029
Balance	$523,288

Manufacturing and Industrial

The General Electric Company and the Edison Lamp Works of the General Electric Company have removed their Los Angeles offices to the Corporation Building, 724 South Spring Street.

The Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, have recently opened a sales office in the Provident Bank Building, Cincinnati, Ohio, which will be under the management of Frank H. Hill.

Los Angeles Electrical Supply Building Destroyed by Fire.—The three-story building occupied by the United States Electrical Manufacturing Company, 461 East Third Street, Los Angeles, Cal., electrical dealer and contractor, was recently destroyed by fire. The loss is estimated to be $150,000.

Grand Prize for Electrical Instrument Maker.—The Bristol Company, Waterbury, Conn., which is maintaining an extensive exhibit of various kinds of electrical and other recording instruments at the Panama-Pacific Exposition, has recently been awarded the grand prize by the International Jury of Awards.

The Rochelle Electric Manufacturing Company, Rochelle, Ill., has recently been formed and will be engaged in the manufacture of wire and motors. S. D. Binkowitz, who is connected with the American Insulated Wire & Manufacturing Company of Chicago, is president of the concern; Mr. Becker is vice-president, and Mr. Leo Mann secretary and treasurer.

New Factory for Specialty Manufacturer.—The Hamilton-Beach Manufacturing Company of Racine, Wis., is constructing a new factory which is expected to be ready for occupancy by Jan. 1, 1916. The structure will be three stories high and will contain 70,000 sq. ft. of floor space. A new 225-hp. power plant in an adjacent building will supply energy for operating the machinery of the new factory.

The Hess-Bright Manufacturing Company, Front Street and Erie Avenue, Philadelphia, Pa., reports that the following manufacturers of ball bearings have entered into permanent license contracts with it: The Standard Roller Bearing Company, Philadelphia; the New Departure Manufacturing Company, Bristol, Conn.; the Gurney Ball Bearing Company, Jamestown, N. Y., and the United States Ball Bearing Company, Chicago.

Opening of the Kuhlman Electric Company's New Plant.—The Bay City (Mich.) Board of Commerce recently sent out an announcement stating that Thursday evening, Oct. 28, was to be devoted to the formal opening of the new plant of the Kuhlman Electric Company. As stated in the ELECTRICAL WORLD of Sept. 11, the Kuhlman Electric Company, which is a maker of transformers, has moved from Elkhart, Ind., to Bay City, Mich.

The Electric Truck Service Company, Salt Lake City, has recently been organized to furnish electric batteries and electric-battery service for electric trucks. A. O. Whitmore, who is president of the concern, has maintained an agency and garage for electric pleasure vehicles in Salt Lake City for several years. G. B. Turner, for several years identified with the automobile industry, is manager of the new concern. The company has leased and remodeled for use as a garage a large building on Second Street formerly used by the Utah Light & Railway Company as a carhouse.

Milwaukee Electric Show Association Recently Formed.—Representatives of the electrical industry in Milwaukee recently organized the Milwaukee Electric Show Association for the purpose of boosting the celebration of Electrical Prosperity Week. During that week a show will be held in the auditorium at Milwaukee. R. M. Van Vleet has been elected president of the association, Philip Grossman vice-president, S. J. Gates secretary, and P. C. Burrell treasurer. The incorporators are H. P. Andrae, Philip Polacheck, E. L. Burdick, H. J. Meyer, R. M. Van Vleet, S. B. Way, H. L. Seymour and C. L. Benjamin.

American Chamber of Commerce in China.—At a recent meeting of American business men in Shanghai, China, by-laws and rules were adopted for the organization of the American Chamber of Commerce in China. The object of the chamber is to further the interests of American commerce in China. This represents the first steps taken by American business interests to effect an American trade organization to assist, in a general way, the advancement of the interests of American trade in China. Similar American chambers of commerce have been formed in Spain, Milan, the Levant, Naples, Brazil and Amsterdam.

Decrease in Output of Mica in India.—The mica industry in India has suffered considerably, it is reported, on account of the war. A large proportion of the demand for the mineral has come from Germany for use in the manufacture of electrical apparatus. Certain firms with German interests which were large purchasers of mica have, it is stated, closed down. The exports of mica to other countries in Europe have practically been cut off, and the industry generally has been hampered very much by the very high rates for ocean freights and insurance brought about by the war. A number of the mines have been closed.

Electric Trucks for Boston Express Service.—The American Express Company has ordered six new electric trucks from the General Vehicle Company for service in Boston beginning early in 1916, in the interest of further reducing costs in local deliveries and collections. The company is now operating about thirty-five electric trucks in Boston. The new equipment consists of four 5-ton and two 3.5-ton wagons. All these machines are charged at the company's garage in South Boston, and their service extends throughout Greater Boston. The first installation was made about five years ago. Most of the trucks are of the 2-ton size.

Electric Car Sales Campaign Extended.—Excellent success has been achieved in the special sales campaign carried out this month in behalf of the "Ward special," a 750-lb. electric delivery wagon. This campaign and the special offer made with it were restricted to Greater New York, nearby New Jersey, Long Island and Westchester County and were to end Oct. 31. So many inquiries were received, however, that it was impossible to attend to them within the allotted time. At the unanimous request of all the co-operating companies the Ward Motor Vehicle Company agreed to extend the period of the special offer to Dec. 4, which is the final day of Electrical Prosperity Week.

Effective Method of Numbering Apparatus When Photographed.—In photographing manufactured products of small size in groups it is often necessary to number the individual pieces for reference in a catalog or tabulation. Instead of using the ordinary pasteboard tags with numerals written in pen or pencil, the scheme was recently tried of cutting out the figures of an old calendar and placing these to correspond with the plug and receptacle numbering on the background used. The method was remarkably successful, took practically no time in preparation, and cost almost nothing. Numbered in this way, each product photographed "stood out" with extraordinary clearness, thus enabling quick comparisons to be made with the utmost facility.

Repeat Order for Electric Ranges.—Some twelve months ago the Utah Power & Light Company of Salt Lake City closed a contract with Brigham Whitmore to install twenty-six electric ranges in a new apartment house. The installation has proved so successful that Mr. Whitmore has decided to replace gas ranges in another apartment house which he owns with electric ranges, and accordingly he recently entered into a contract to purchase eighty Hughes ranges from the Utah Power & Light Company. It is stated that the electric ranges prove a distinct advantage in influencing prospective renters to take apartments equipped with electrical apparatus. The success of the initial installation of electric ranges in Salt Lake City apartment houses, it is said, also influenced the owners of six other apartment buildings in the city to install electric ranges in their houses during the past year.

Co-operative Branches of Bureau of Foreign and Domestic Commerce.—At the request of the merchants of almost forty cities seeking to establish American goods in foreign markets, plans are on foot for the establishment of a number of co-operative branches of the National Bureau of Foreign and Domestic Commerce. Six such branches have already been formed, four more will be launched shortly, and twenty-five cities are in possession of data relative to starting a co-operative branch. The Bureau of Foreign and Domestic Commerce at Washington says: "The movement has sprung

up within a few months. The European war has hastened its development. Every co-operative branch of the Bureau of Foreign and Domestic Commerce that is established increases the force with which the main office can demonstrate to foreign countries the advantages of dealing with Americans. The bureau welcomes the opportunity to offer its facilities to the men who are manufacturing goods in these widely scattered communities."

Sales Convention of the Robbins & Myers Company.—The annual sales convention of the Robbins & Myers Company was held at Springfield, Ohio, Oct. 20, 21 and 22. The mornings were devoted to general discussions. On Wednesday morning there was a discussion on fan sales, the meeting being presided over by W. W. Mumma, fan sales manager. The first session on Thursday morning was devoted to discussions on motor sales and was conducted by Eugene Newnham, sales manager of the motor department and supervising engineer. Led by C. H. Clark, advertising manager, the men present at the second session talked on various phases of advertising. C. C. Miner, auditor of the company, presided over the Friday morning session, which included talks on credits and collections. Individual conferences between the branch offices and the various departments of the home office took place on Wednesday and Thursday afternoons. A schedule was given to each of the visitors showing him the hour allotted him for his visit with the motor sales, fan sales, advertising, engineering and credit departments. On Friday at noon the real business of the convention was brought to a close, and all the delegates were taken in two of the company's trucks to the log cabin of W. A. Meyers, secretary of the company, where they were entertained with a buffet lunch.

NEW YORK METAL MARKET PRICES

	Oct. 26 Selling Prices Bid	Oct. 26 Selling Prices Asked	Nov. 3 Selling Prices Bid	Nov. 3 Selling Prices Asked
	£ s d	£ s d	£ s d	£ s d
London, standard spot	72 2 6		74 10 0	
Prime Lake	17.75	to 18.00	18.00	to 18.12½
Electrolytic	17.62½	to 17.87½	18.00	to 18.12½
Casting	17.12½	to 17.37½	17.50	to 17.75
Copper wire base	19.00	to 19.25†	19.12½	to 19.37½†
Lead	4.75		4.90	
Nickel	45.00	to 50.00†	45.00	to 50.00†
Sheet zinc, f.o.b. smelter	16.00†		16.00†	
Tin, Straits	33.70		36.00†	
Aluminum, virgin, 99 per cent	54.00	to 56.00‡	56.00	to 58.00†

OLD METALS

Heavy copper and wire	15.00	to 15.25†	15.00 to 15.25†
Brass, heavy	10.00	to 10.25†	10.00 to 10.25†
Brass, light	8.00	to 8.50†	8.50 to 9.00†
Lead, heavy	4.12½	to 4.25†	4.25 to 4.35†
Zinc, scrap	10.00	to 10.50†	10.00 to 10.50†

COPPER EXPORTS

Total tons to Nov. 3.....None

†Nominal.

New Industrial Companies

The Howell General Electric Motors Company, Howell, Mich., has been incorporated with a capital stock of $30,000. The officers are: H. M. Spencer, Howell, president; Carl L. Dann, Saginaw, vice-president and general manager.

The Standard Electric & Supply Company, New Haven, Conn., has been incorporated with a capital stock of $25,000 to deal in electrical machinery, etc. The incorporators are Carl F. Richmond, Mabel D. Richmond and Kenneth Mintie, all of New Haven.

The Micropho-Detector Company, New York, N. Y., has been incorporated by Frank O'Donnell, R. H. Waddell and H. H. Nieman, 220 Broadway, New York, N. Y. The company is capitalized at $10,000 and intends to manufacture electric devices, wireless instruments, microphones, etc.

The Phœnix Machine Company, New York, N. Y., has been incorporated by H. O. Coughlin, S. A. Anderson and Joseph F. Curtin, 36 Nassau Street, New York, N. Y. The company is capitalized at $50,000 and purposes to do a general electrical engineering, foundry, machinery and contracting business.

New Incorporations

The Poulsbo Light & Power Company, Poulsbo, Wash., has been incorporated by J. C. Moe, Elmer Nilsen and A. S. Ryland.

The Marion Light & Power Company, Marion, Wis., has been chartered with a capital stock of $5,000. The incorporators are J. H. Dreissen, O. F. Rieche and A. Rieche.

The Ocean County Electric Company, Camden, N. J., has been incorporated by Joseph P. Murray, Leighton P. Stradley of Philadelphia, Pa., and F. Stanley Saurman, Churchville, Pa. The company is capitalized at $525,000 and purposes to build a dam across Toms River between the towns of Toms River and Allenhurst, the power to be used to generate electricity for industrial purposes.

Trade Publications

Electrical Fittings.—The Underwriters' Laboratories, Inc., Chicago, Ill., is sending out a list of electrical fittings which is a supplement to a list issued April, 1915.

Light-Weight Portable Vacuum Cleaner.—The Frank Ridlon Company, Boston, Mass., has recently issued an illustrated folder on its portable vacuum cleaner.

Fiber Gears.—The Diamond State Fiber Company, Bridgeport, Pa., has prepared Bulletin No. 13, which gives some details on the use of fiber for making gears.

Battery-Operated Lantern.—The Hytee's Factories, Inc., Indianapolis, Ind., has published several illustrated folders on its "Dad's" lantern, which is operated by two ordinary dry cells.

Electric Appliances.—The Hamilton-Beach Manufacturing Company, Racine, Wis., has prepared a folder which contains information on its vibrators, hair and shoe driers and drink mixers.

Hard Fiber.—The Delaware Hard Fiber Company, Wilmington, Del., has published a complete catalog which contains information on hard fiber and lists the various uses to which the fiber can be put.

Fixtures for Nitrogen-Filled Lamps.—All-brass ventilated holders and units for nitrogen-filled lamps are the subject of Bulletin Serial No. 107, prepared by the F. W. Wakefield Brass Company, Vermilion, Ohio.

Direct-Current and Alternating-Current Machinery.—The Burke Electric Company, Erie, Pa., has recently issued a small folder which lists the various types of machinery made by the company and gives a partial stock list.

Pull Switches.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has just issued a four-page folder printed in two colors which contains information on 6-amp. pull switches of the ceiling, pendent and threaded-cap type.

Coloring for Incandescent Lamps.—The Universal Electric State Lighting Company, 240 West Fiftieth Street, New York, has issued a leaflet which contains information on its "signaloid," which is a material for coloring lamps.

Household Appliances.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has prepared an illustrated folder entitled "Summer Comfort Everywhere" which lists a number of electrically operated cooking appliances.

Lighting Fixtures and Household Appliances.—The Alter Light Company, 827 South Loomis Street, Chicago, Ill., has prepared an illustrated folder containing information on fixtures for nitrogen-filled lamps and on an electric iron and toaster.

Small Direct-Current Meters.—"Junior Imp" is the title of a bulletin published by the Roller-Smith Company, 203 Broadway, New York, which describes small direct-current ammeters and voltmeters for battery-charging outfits, small switchboards and similar installations.

Electric-Railway Material.—The General Electric Company, Schenectady, has recently issued Bulletins No. 44,012, on electrical equipment for the Puget Sound Lines of the Chicago, Milwaukee & St. Paul Railway; No. 44,005, on line material and rail bonds for mine and industrial haulage, and No. 47,010, on standard-unit direct-current switchboard panels for railway service.

Construction News

New England

MONTAGUE CITY, MASS.—The Turners Falls Pwr. & El. Co., Greenfield, is planning to install a fourth generator in the new power house at Montague City. The foundation was laid when the building was erected.

STOUGHTON, MASS.—Ground has been broken for the new substation for the Edison El. Illg. Co. of Brockton at Washington and Kingsley Streets. This is to take the place of the one on Rose Street.

Middle Atlantic

ALBANY, N. Y.—A permit has been granted by the Building Bureau for the construction of the Riverside power station of the Municipal Gas Co. in the lumber district. The cost of the superstructure is estimated at $100,000.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Nov. 15 for installing electric-lighting equipment in Public Schools 3, 9, 11 and 46, borough of Brooklyn. Separate bids to be submitted for each school. Blank forms, plans and specifications may be obtained or seen at the above office and also at 131 Livingston Street, Brooklyn.

ELMIRA, N. Y.—The Morrow Mfg. Co., Elmira, has purchased 12½ acres of land adjoining its present plot on the South Side to furnish sites for future additions, including the new power plant now under construction. The company manufactures machinery and auto parts.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Nov. 15 for installing electric-lighting equipment in Public Schools 18, 37, 51, 69 and 135, borough of Manhattan. Separate proposals to be submitted for each school. Blank forms, plans and specifications may be obtained at the above office.

NEW YORK, N. Y.—The Public Service Commission, Second District, has approved the franchises granted by the city of New York to the Yonkers El. Lt. & Pwr. Co., Yonkers, and the Westchester Ltg. Co., Mount Vernon, for the erection of an electric transmission line along the aqueduct lands in Westchester County, and a contract whereby these companies and the New York Edison Co. and the United El. Lt. & Pwr. Co. may use the lines in return for furnishing the city with current which it will need in operation of the aqueduct.

PATTERSON, N. Y.—The Public Service Commission has approved the franchise granted by the town of Patterson to Ralph Griffin for the construction of an electric-light plant and distribution system in the town.

RANDOLPH, N. Y.—The Public Service Commission has approved the franchises and construction plans of the Randolph Lt. & Pwr. Co. in Randolph, East Randolph, Ellington, Conewango and Cherry Creek, for the distribution of electricity for lamps and motors. The commission has also approved an issue of $30,000 in capital stock, the proceeds to be used to pay for construction work.

NORRISTOWN, PA.—The Adam Scheidt Brewing Co. will soon erect a large three-story brick, steel and concrete bottling house in Norristown. All machines, it is said, will be electrically driven. Peuchert & Wunder, 310 Chestnut Street, Philadelphia, are architects.

OBERLIN, PA.—A petition to be presented to Board of Township Commissioners is being circulated asking that an electric-lighting system be established in Oberlin.

PHILADELPHIA, PA.—A one-story building, to cost about $250,000, will be erected at the corner of Twelfth and Chestnut Streets for the Beneficial Savings Fund Society. Special attention, it is understood, will be given to the electrical installation.

PITTSBURGH, PA.—The West Penn Trac. Co., Pittsburgh, has closed a contract with the Frick Coal Co. under which the traction company will supply energy for use in the Frick coal mines in the Connellsville district.

SHARON, PA.—Arrangements are being made to equip the plant of the Knox Press & Welded Steel Co., Sharon, for electrical operation. Energy to operate the plant will be obtained from the Mahoning & Shenango Lt. & Pwr. Co.

WILLIAMSPORT, PA.—The property of the Williams Valley Lt., Ht. & Pwr. Co. has been transferred to the Lykens Valley Lt. & Pwr. Co. of Wiconsico Township. The consideration was $100,000.

BORDENTOWN, N. J.—The Board of Commissioners is negotiating with the Pub. Ser. El. Co. for the installation of new street lamps on Farnsworth Avenue. Initial tests will be made with nitrogen-filled lamps.

KEARNEY, N. J.—The new five-year street-lighting contract awarded by the Common Council to the Public Ser. El. Co. provides for the installation of a new lighting system along Kearney Avenue. Arc lamps, it is understood, will be used.

TRENTON, N. J.—The contract for electrical work for the new admission building at the State Hospital at Trenton has been awarded to the Strang El. Co., 214 South Seventh Street, Philadelphia, Pa., at $4,024.

VENTNOR CITY, N. J.—Bids will be received by the Common Council of Ventnor City, City Hall, Ventnor City, until Nov. 22 for furnishing and installing complete mechanical equipment for water-works plant, including new building for housing the new and old machinery as follows: New pumping station, concrete foundations for all machinery, one triple-expansion, direct-acting pumping engine, one cross-compound, two-stage air compressor, one high-speed engine with directly connected generator, one surface condenser with combined air and circulating pump, two feed-water heaters, removing and resetting two old air compressors, removing and resetting two old pumping engines, re-piping four artesian wells, suction and discharge mains to pumps and reservoir, steam and exhaust connections to all machinery, resetting water meter, new switchboard with all instruments and connections. Plans and specifications may be obtained from the city clerk upon deposit of $25. E. Steelman Royal is city clerk.

WOODBRIDGE, N. J.—Bids will be received by the Township Commissioners until Nov. 9 for lighting the streets of District No. 6, Woodbridge Township.

NEWARK, DEL.—Bids will soon be asked, it is reported, by the Delaware State College for the construction (complete) of a large agricultural building. Day & Klauder, 925 Chestnut Street, Philadelphia, Pa., are the architects.

BALTIMORE, MD.—The Board of Estimate has authorized Raleigh C. Thomas, chief engineer of the electrical commission, to resume work on the municipal conduit system, for which $15,000 has been appropriated.

EASTON, MD.—The Newton El. Co., Newton, it is reported, is negotiating for the erection of an electric transmission line from Easton to Oxford, a distance of about 15 miles. It is proposed to secure electricity from the municipal electric plant at Easton.

CLARKSBURG, W. VA.—Bids will be received by the Water Works and Sewerage Board at the office of Scotland G. Highland, secretary, Clarksburg, until Nov. 26 for furnishing and installing complete with appurtenances two gas engines and two pumps at the pumping station. Plans and specifications are on file at the office of the board and the office of George W. Fuller, consulting engineer, 170 Broadway, New York, N. Y., from whom copies may be obtained.

ATKINS, VA.—D. B. Musser, it is reported, is contemplating the installation of an electric-light plant, and he would like to receive prices on a second-hand electric generator, capable of supplying electricity to maintain 300 lamps; would also consider entire second-hand equipment for plant.

HOPEWELL, VA. (not a post office).—Two of the power houses of the Du Pont Mfg. Co. at Hopewell were recently destroyed by fire, causing a loss of between $75,000 and $100,000.

HOPEWELL, VA.—The Prince George El. Co., Hopewell, has engaged Stuart & James, consulting engineers, 50 Church Street, New York, to supervise the installation of an electrical distribution system in Hopewell.

OAK RIDGE, VA.—C. H. Yates, manager of Oak Ridge Farm, Oak Ridge, would like to receive estimates on equipment for pole line as follows: 200 25-ft. (7-in. top) poles, long-leaf pine; 200 four-pin cross-arms, complete with locust pins; galvanized-iron braces (12 in. by 14 in.), through bolts, round bolts, 800 D. P. S. G. porcelain insulators, two 15-kw., 1100/110-volt type H General Electric transformers, 7000 lb. No. 6 triple-braid, weather-proof wire, 2000 ft. ½-in. stranded galvanized guy wire, 50 three-bolt guy clamps, 50 composition high-tension strain insulators, etc.

WAVERLY, VA.—Bonds to the amount of $50,000 have been voted, the proceeds to be used to purchase the local electric-light plant (to be owned and operated by the municipality), and to construct water-works and sewage-disposal system.

WASHINGTON, D. C.—Bids will soon be asked for the construction of six new preparatory school buildings, to cost over $400,000, for the Georgetown University. George D. Hamilton is president of board of trustees; Marsh & Peters, Washington, are architects.

North Central

AKRON, MICH.—Preparations are being made by J. A. Irwin, it is reported, for the installation of an electric-light plant in Akron to supply electricity here. Mr. Irwin, it is understood, has a ten-year contract for lighting the streets of the town.

DETROIT, MICH.—Plans are being prepared by Harry J. Hill, architect, for a set of college buildings; main building, 194 ft. by 150 ft., and power plant, all reinforced concrete, for which bids will be received until Nov. 20. Location not given.

Installing a 3500-Kw. Rotary on the Second Floor of Substation

The scaffold structure shown, in front of the New York Edison Company's substation on Thirty-ninth Street, was employed during construction to transfer heavy 3500-kw. rotary converters from delivery trucks at the street level to the operating floor, which is 21 ft. above the pavement. Trucks delivering the converter parts were backed

up under the frame, and the load was hoisted by blocks and tackle. To prevent injury to the parts hoisted in case the tackle broke, a timber crib was built up under the load as fast as it was hoisted. When the machinery was raised to the converter-room floor level skids and rollers were placed under it so it could be moved horizontally into the building through the entrance provided. The final placing of the converters was performed by a 50-ton hand-operated crane traveling the length of the converter room. The sections making up the structure shown outside the building have since been separated and stored on the substation roof until the remainder of the equipment comes to be installed.

Installing the storage batteries on the three upper floors was work of more than usual importance. The jar, cases and plates had to be hoisted a distance of 55 ft. to 93 ft. and unloaded from platforms extending from each floor outside the windows. This was done by means of the derrick shown on the roof of the substation. When not in use this equipment can also be taken apart and stored in the penthouse.

A rather unusual method was employed for filling the storage batteries with electrolyte. Instead of mixing the concentrated acid with the required amount of distilled water on the battery floors, which would have required hoisting all acid carboys to the respective floors, the electrolyte was mixed in a lead-lined tank on the street level and forced by means of a motor-driven centrifugal pump through a hose to the battery jars. This saved considerable time and labor and minimized the chance of waste.

GRAND RAPIDS, MICH.—The City Council has voted to install an ornamental street-lighting system on Lyon Street from Monroe to Ionia Avenue, and on Ottawa Street from Monroe Avenue to Louis Street.

BELLEFONTAINE, OHIO.—Plans submitted by F. H. Froehlich, electrical engineer, for the new street-lighting system have been approved by the Board of Control and public utilities committee. It has been decided to adopt the one-lamp s ard, of which 100 will be installed. Bids, it is expected, will soon be called for.

CANTON, OHIO.—Bids will be received by the Board of Education, Canton, until Nov. 22 for electrical and other work in connection with the construction of the new Daniel Worley School building. Plans and specifications are on file at the office of the Board of Education and at the office of Edmund Herrman, architect.

COLUMBUS, OHIO.—Joint application has been made to the Public Utilities Commission by the El. Lt. Co. of Ottawa and the Northwestern Ohio Lt. Co., Toledo, for the purchase by the latter of the property and holdings of the Ottawa company for $75,000. The Northwestern company has asked for permission to issue $40,000 in capital stock and $35,000 in bonds to pay for the property.

EATON, OHIO.—The Eaton Ltg. Co. has increased its capital stock from $50,000 to $80,000, the proceeds to be used for extension of its transmission line and service to Camden, Ohio.

LIMA, OHIO.—Plans have been prepared by the Cincinnati, Hamilton & Dayton R.R. Co., it is reported, for the construction of a power plant in Lima, to cost about $23,000. H. B. Voorhees, Cincinnati, is general superintendent.

MANSFIELD, OHIO.—The Mansfield El. Co. is contemplating extending its transmission line to Bellflower, 7 miles distant, to supply electricity there. Later a line may be erected to Mahomet.

YOUNGSTOWN, OHIO.—Residents of Church Hill, north of the city, are promoting a project to have the city street-lighting system extended to that village by extending the system on Belmont Avenue. It is estimated that about 50 lamps would be required. A problem soon to confront the city in the lighting system is that of lighting the township line roads running between Youngstown, Boardman, Austintown, Poland and Coitsville townships for a distance of several miles.

BEREA, KY.—The electric-light and power franchise recently sold by the Town Council has been purchased by the Isaacs & Baker Co.

FLEMINGSBURG, KY.—The Flemingsburg. Lt. & Ice Co. is changing its system from direct to alternating current, 2300 volts, and will install new equipment, including a complete generating unit consisting of a 75-kva. generator and engine; also a 75-kva. generator without engine, transformers, lightning arresters, wire, etc. Contracts have not yet been placed for machinery. Charles E. Cooper is secretary and manager.

LOUISVILLE, KY.—The Ford Motors Co., Detroit, Mich., will install two electric enameling furnaces in the new assembling plant which it has just established in Louisville. The furnaces will be supplied by the General Electric Co.

MATER, KY.—Wiley W. Gibson & Son, Mater, it is reported, are contemplating the purchase of equipment, including engines and boilers, for an electric-light plant.

SOUTH BEND, IND.—The County Commissioners have granted the Indiana & Michigan El. Co. two franchises to erect high-tension transmission lines along the public highways. The first franchise allows the company to erect a line from Twin Branch to Mishawaka, and the other to Lakeville to enable the company to supply electrical service in that town.

PONTIAC, ILL.—The City Council has entered into a contract with the Public Ser. Co. of Northern Illinois for a cluster-lamp street-lighting system for a period of five years.

ST. FRANCISVILLE, ILL.—The installation of a municipal electric-light plant in St. Francisville is under consideration.

SPRINGFIELD, ILL.—The City Commission has approved the plan of Commissioner W. J. Spaulding for the installation of 750 new arc lamps and other apliances, to cost about $10,000. Bids will be received until Nov. 8.

WEST SALEM, ILL.—Contracts, it is reported, have been placed for the installation of an electric-lighting plant in West Salem.

BLOOMINGTON, WIS.—The stockholders of the electric-light company are reported to have accepted the proposal to install an electric-light plant in Bloomington, to cost about $12,000.

LOWELL, WIS.—Application has been made to the Village Council by George O. Pease, owner of the flouring mill, for a franchise to furnish electricity for lighting the streets and residences of the villages.

SHAWANO, WIS.—The proposal to issue $60,000 in bonds for the construction of a dam and hydroelectric power plant on Wolf River will soon be submitted to the voters.

SHEBOYGAN, WIS.—The City Council has voted to appropriate $6,000 for the installation of a new police-alarm system. Plans are also being considered for the installation of an ornamental lighting system in the business district.

SPARTA, WIS. — Improvements are being made to the power station of O. I. Newton's Sons Co. at Angelo, about 3 miles from Sparta. New equipment includes a new 500-hp. Twin City Corliss engine, two Stirling boilers, a 300-kw. generator and all necessary accessories. The work will be completed in about a month. G. M. Newton is president.

CROOKSTON, MINN.—Bids will be received by the State Board of Control, State Capitol, St. Paul, until Nov. 12 for the construction of a Nurses' Home in connection with the tuberculosis sanatorium for the counties of Polk and Norman, including general construction and mechanical equipment. Plans and specifications may be seen at the office of Sund & Dunham, Essex Building, Minneapolis, and at the Builders' Exchanges in Minneapolis, St. Paul and Duluth.

DEERWOOD, MINN. — The Cuyuna Range Pwr. Co., Deerwood, is reported to be contemplating enlarging its plant.

DULUTH, MINN.—The installation of an ornamental lighting system on East Fourth Street is under consideration.

MAHNOMEN, MINN.—The Village Council is negotiating with H. Reichert, Vesta, for the sale of the municipal electric-light plant. The plant, it is understood, will be rebuilt if taken over by Mr. Reichert. A 24-hour service would be installed as soon as improvements were completed.

SAUK. CENTER, MINN.—The Public Service Co. of St. Cloud has secured a 60-day option on the electric light and power plant of the Central Minnesota Pwr. & Milling Co., Sauk Rapids. If the local plant is taken over, the lines will be rebuilt at once and the system will be operated by energy transmitted from St. Cloud. An auxiliary plant will also be built to supply towns northwest and south of Sauk Center. A. G. Whitney is president of the Public Service Company.

BRISTOW, IOWA.—The Cedar Valley Pwr. Co., Charles City, has applied for a franchise to supply electricity in Bristow.

CORWITH, IOWA.—Preparations are being made for the installation of a municipal electric-lighting system in Corwith, for which $5,000 in bonds were recently voted. Energy for operating the system will be secured from the Northern Iowa Pwr. Co., Humboldt, which will erect a transmission line to supply the service. The towns of Livermore and Luverne are to secure service from the same line, which has already been erected and connected at Livermore, and the contractors will soon begin work at Luverne. The contract for construction of line between Luverne and Corwith will be let in the near future. The transmission line will carry 23,000 volts. Rasch & Brooks, Fort Dodge, are engineers in charge.

EARLING, IOWA.—The Stinn Implement Co. is building an addition to its electric plant. Contracts have been placed for a 15-hp. engine and a new generator. When improvements are completed a day service will be established.

FORT MADISON, IOWA.—The Fort Madison El. Co. is contemplating the construction of a substation, equipped with transformers, switchboards, etc., to transform electricity received for local distribution.

GILBERT, IOWA.—Local business men and residents of the town of Gilbert are considering the question of securing electrical service for this town. For further information address A. Matteson.

KEOKUK, IOWA.—The Mississippi River Pwr. Co., Keokuk, has applied to the State Public Utilities Commission of Illinois for a certificate of convenience and necessity to erect a 12-mile spur from its main transmission line to the city of Carthage, Ill. Over this line energy will be supplied to the Central Illinois Pub. Ser. Co.

MARENGO, IOWA—The Iowa El. Co. Marengo, it is reported, is planning to make extensions to its transmission lines.

MONTICELLO, IOWA.—The Monticello El. Lt. Co. has entered into a contract with the Iowa Ry. & Lt. Co., Cedar Rapids, to furnish the latter with energy from the local power plant. The Iowa company will extend its transmission line from Amber, about 8 miles from Monticello, for which surveys have already been made.

POCAHONTAS, IOWA. — The Town Council is considering the question of entering into a contract with the town of Laurens to purchase electricity.

STOCKPORT, IOWA.—At an election held recently the proposal to grant J. E. and T. E. Bales a franchise to install and operate an electric-lighting system in Stockport for a period of 25 years was carried.

WAVERLY, IOWA. — Application has been made by the Cedar Valley Hydraulic Co. for permission to erect transmission lines to distribute electricity for lamps, heaters and motors.

BEVIER, MO.—Bonds to the amount of $12,000 have been voted for the installation of a municipal electric-lighting plant in Bevier.

JEFFERSON, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 29 for the installation of a new hoistway, an electric freight elevator, etc., in the United States court house and post office at Jefferson City. For details see proposal columns.

STEELVILLE, MO.—The Steelville El. Lt. & Pwr. Co. has applied to the Public Service Commission for permission to install an electric-light plant in Steelville, to cost about $10,000.

ASHTON, S. D.—Steps have been taken to organize a company, to be known as the Spring County Pwr. Co., to install an electric light and power plant here to supply electricity in Ashton and many of the smaller towns in this locality. F. W. Boyle of Garden City is interested, and Hugh Triplett of Redfield will be manager.

MITCHELL, S. D.—The South Dakota Short Line Ry., recently incorporated with a capital stock of $2,000,000, is contemplating the construction of an electric railway from Mitchell to Pierre. G. W. Adams, Council Bluffs, is interested in the company.

WOONSOCKET, S. D.—The Schuler El. Co., it is reported, is contemplating furnishing electricity for lamps and motors in the towns of Forestburg and Artesian.

AINSWORTH, NEB.—The City Council is asking for bids for lighting the city.

ATWOOD, KAN.—Contracts have been awarded for the construction of the municipal electric-light plant as follows: For erection of power house, pole line, installation of ornamental lighting system, generators and storage battery to F. D. Martin Construction Co., Rialto Building, Kansas City, Mo., at $11,727, and for engine to Fairbanks, Morse & Co., Thirteenth and Liberty Streets, Kansas City, Mo., at $1,860.

CHAPMAN, KAN.—For the third time the people of Chapman have voted to issue $8,000 in bonds for improvements to the municipal electric-light plant. The previous elections were pronounced illegal owing to technical errors.

GARDEN CITY, KAN.—At an election held recently the proposal to purchase the electric-light plant and telephone system of the Garden City Tel., Lt. & Pwr. Co. was defeated.

HARDTNER, KAN. — Application has been made to the City Council for a franchise to install and operate an electric-lighting system in Hardtner.

LAWRENCE, KAN.—The Kansas El. Utilities Co., Lawrence, recently incorporated with a capital stock of $600,000, has applied to the Public Utilities Commission for permission to issue $400,000 in capital stock and $1,500,000 in bonds. The company also asks for authority to do business in the State as a common carrier and public utility. Arrangements, it is understood, have practically been completed by the company for the purchase of the properties and holdings of the Parsons (Kan.) Ry. & Lt. Co., the Emporia (Kan.) Ry. & Lt. Co., and the Lawrence (Kan.) Ry. & Lt. Co. R. F. Rice, Lawrence, is attorney for the utilities company.

OAKLEY, KAN.—Bids will be received by the city clerk, Oakley, until Nov. 23, for furnishing material and constructing an electric-light plant, separate bids to be submitted as follows: (1) One 75-hp. oil engine; (2) one 50-kw. engine-driven alternator, three-phase, 2500 volts, 60 cycles, and belted exciter; one 15-hp. induction motor, generator panel complete with instruments, and other extra instruments which will be required. Plans and specifications are on file in the offices of the city

clerk, Oakley, and George P. Taylor, engineer, Stockton.

OTTAWA, KAN.—The City Council is considering the installation of an ornamental lighting system from the Santa Fé depot to Fourth and Main Streets, six blocks. The plans provide for 15 standards to the block.

SENECA, KAN.—At an election held recently the proposal to grant the Standard Engineering Co. a franchise to construct and operate an electric-light plant in Seneca was carried. The company, it is reported, agrees to begin work within 90 days.

Southern States

DURHAM, N. C.—The Durham Trac. Co. is contemplating improvements to its system, including railway switchboard, auxiliary equipment and pumps for power house and six cars.

SALISBURY, N. C.—The Southern Pwr. Co., Charlotte, N. C., it is reported, is contemplating enlarging its local substation and installing additional equipment.

STANTONSBURG, N. C.—Preparations are being made for the installation of a municipal electric-lighting plant.

ERWIN, TENN.—The Elrod Mfg. Co., which has purchased the plant of the Unaka El. Co., Erwin, is enlarging the plant and, it is understood, will install new equipment.

MASON, TENN.—Steps have been taken to organize a company to install an electric-light plant in Mason.

AUSTINVILLE (R. F. D. from NEW DECATUR), ALA.—The Alabama Pwr. Co. has been granted a franchise to supply electricity in Austinville. Work has begun on the erection of a transmission line.

PASS CHRISTIAN, MISS.—The report on municipal improvements prepared by Xavier A. Kramer, consulting engineer, Magnolia, Miss., submitted to the joint aldermanic-citizens' committee recommends the installation of electric light and power plant in conjunction with the water-works system, new fire-water system, including necessary wells, reservoir, water tower, mains, street improvements and city hall; total cost is estimated at $114,000.

UTICA, MISS.—The Council has engaged Xavier A. Kramer, Magnolia, to prepare plans for an electric-light plant, reconstruction of pumping station, and for increasing water supply.

MOUNTAIN HOME, ARK.—The City Council has granted L. J. Goodrich and Dillon Undergill, Mountain Home, and H. M. Tatum, Sparkman, a franchise to install an electric-light plant in Mountain Home. The proposed plant will have sufficient output to maintain 3000 lamps.

OZARK, ARK.—The local electric-light plant is reported to have been purchased by W. C. Bill and Arthur Du Priest.

YELLVILLE, ARK.—The Yellville Lt., Ice & Pwr. Co., recently organized by W. C. Stephenson, Marshall, is planning to install an electric-lighting system and to construct an ice plant. Mr. Stephenson was recently granted a franchise to build an electric-light plant in Yellville.

FAIRFAX, OKLA.—Preparations are being made by C. I. Huffaker, recently granted a 25-year franchise, to construct and operate an electric-light plant in Fairfax. Contracts have been placed for equipment for plant and distributing system with Fairbanks, Morse & Co., Kansas City, Mo. The generating machinery will consist of a 40-hp. oil engine and a 30-kw., three-phase alternator.

AUSTIN, TEX.—The Austin Street Ry. Co., it is reported, has awarded contract for the construction of a power house, to cost $5,000.

BEEVILLE, TEX.—The City Council has engaged Barlett & Ranney, consulting engineers, San Antonio, to prepare preliminary plans for electric-light plant and water-works system.

BRENHAM, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 27 for construction, including mechanical equipment and approaches, of the United States post office at Brenham, Tex. Drawings and specifications may be obtained at the above office or from the custodian of site at Brenham.

DALLAS, TEX.—The City Commission has granted an amended franchise for trackage rights in this city to the Dallas Northwestern Trac. Co. and the Dallas Southwestern Trac. Co., both of which belong to the same interests, in which it is stipulated that work on the construction of 20 miles of the proposed interurban lines must begin within six months of the time the ordinance becomes effective and be completed within 14 months. The Dallas Northwestern company proposes to build an electric railway from Dallas to Denton, a distance of about 35 miles, and the Dallas Southwestern company plans to construct an electric interurban railway from Dallas to Stephenville, about 100 miles long.

DECATUR, TEX.—Bonds to the amount of $10,000 have been voted for improvements to the municipal electric-light plant and water-works system.

NAVASOTA, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 26 for construction, including mechanical equipment (except lighting fixtures and approaches), of the United States post office at Navasota, Tex. Drawings and specifications may be obtained at the above office or from the custodian of site at Navasota.

ROTAN, TEX.—The Rotan Wtr. & Lt. Co., it is reported, contemplates extensive improvements to its system.

SAN ANGELO, TEX.—Arrangements, it is reported, are being made by the San Angelo Wtr., Lt. & Pwr. Co. for improvements to electric-light plant and water-works system, to cost about $50,000.

Pacific States

GARFIELD, WASH.—The Garfield Town & Rural Tel. Co. has decided to sell its plant to W. M. Anderson, Tekoa, who will rebuild the lines within the city limits, put in a new switchboard, and secure long-distance connection with the Bell system.

METALINE FALLS, WASH.—Application has been made by Hugh L. Cooper, consulting engineer, 101 Park Avenue, New York, N. Y., to the Department of the Interior, Washington, D. C., for a preliminary permit to start work on the construction of a large power plant in "Z" canyon of the Pend Oreille River near Metaline Falls. The plan provides for an expenditure of $10,000,000 and, it is understood, also calls for the development of the nitrate fields of that district and the manufacture of various chemical materials.

OROVILLE, WASH.—Assistant Secretary of the Interior Bo Sweeney has handed down a decision in favor of the Similkameen Pwr. Co., Oroville, in the controversy over permits to utilize and develop power sites on the Similkameen River. The Okanogan Wtr. Co. contested the rights of the Similkameen company, and the West Okanogan valley irrigation district opposed both power companies and asked for the privilege to develop power in connection with its irrigation project.

SEATTLE, WASH.—Application has been made to Commissioners of King County by the Municipal Light Department of the city of Seattle for a franchise to supply electricity in the southern portion of King County.

VANCOUVER, WASH.—The Washington-Oregon Corpn., which went into the hands of a receiver some time ago, has been reorganized under the name of the Washington-Oregon Utilities Co., with a capital stock of $1,750,000. The company owns and operates power plants, lighting systems and street and interurban railways in Clark and Lewis Counties. The principal offices will be in Vancouver.

EUGENE, ORE.—The Eugene Water Board is contemplating the erection of electric lamps all around the new city reservoir. C. W. Geller is superintendent of board.

LEBANON, ORE.—Preparations are being made by Scroggin & Washburn to rebuild the electric light and power plant, which was destroyed by fire at the same time the sawmill was burned.

BLYTHE, CAL.—Plans have been prepared by the California Farm & Irrigation Co., financed by San Francisco capitalists, for irrigating 60,000 acres of farm lands in Riverside County, near Blythe. The water will be taken from the Colorado River and carried over the intervening hill by a 12,000-hp. hydroelectric plant and distributed into three reservoirs, from which it will be carried by three main canals. Pierre Zucco, San Francisco, is engineer.

COLTON, CAL.—The Southern California Edison Co., Los Angeles, is building an addition (26 ft. by 51 ft.) to its local substation to provide space for additional machinery.

LOS ANGELES, CAL.—The sale of $1,026,000 in municipal power bonds, including $234,000 purchased by the city a few months ago with money from sinking fund, and $792,000 of unsold bonds has been authorized by the City Council. The proceeds are to be used for the completion of the city power plants and construction of transmission lines.

LOYALTON, CAL.—Bonds to the amount of $5,000 have been authorized for the installation of a municipal electric-light plant in Loyalton.

ALBION, IDAHO.—Preparations are being made by the Council for the installation of an electric-lighting system, for which $8,000 in bonds were recently sold. Electricity for operating the system, it is understood, will be obtained from the plant of the United States Reclamation Service at Minidoka.

KENDRICK, IDAHO.—A certificate of public convenience and necessity has been granted to A. V. Dunkle by the Public Utilities Commission for the installation of an electric-light and power plant in Kendrick.

ROCKLAND, IDAHO.—The Public Utilities Commission has granted G. H. Hodgin a certificate of convenience and necessity for the construction and operation of an electric-light plant in Rockland.

GARDEN CITY, UTAH.—The Swan Creek El. Co., Garden City, is planning to enlarge its plant at Swan Creek and extend its transmission lines to Paris, Bloomington, St. Charles and Fish Haven, all in Idaho. The new equipment will include a 400-hp. turbine, one 250-kw., three-phase, 60-cycle generator, directly connected, six 15-kw. step-down transformers, and a number of distribution transformers from 1 kw. to 10 kw. Contracts for machinery will be placed early in the spring of 1916. T. E. Daniels is chief engineer.

SALT LAKE CITY, UTAH.—The Utah Pwr. & Lt. Co., Salt Lake City, will soon begin work on construction of an addition to its hydroelectric power plant on Bear River at Oneida, Idaho, to cost approximately $250,000. The proposed work will consist of enlargement of present power house, installation of additional equipment, including a second 10,000-kw. generating unit, and construction of a new steel penstock connecting the power house and reservoir.

GOLCONDA, ARIZ.—Surveys are being made for the proposed transmission line extension to the Golconda Mine and on to Chloride via the Golconda extension. The line may possibly be extended to Cerbat and to other points in the Wallaipai district, and eventually to White Hills.

PHOENIX, ARIZ.—Preliminary surveys for the six dams to be erected at the sites of the six proposed hydroelectric power plants in the Grand Canyon of the Colorado will be made by J. B. Girard, city engineer of Phoenix. The plans provide for the erection of the first power plant in Diamond Canyon north of Peach Springs, where it is estimated that 50,000 hp. can be developed. The six plants, it is expected, will develop about 400,000 hp. Permission has been granted by the Department of the Interior for the preliminary surveys to be made.

BOX ELDER, MONT.—The Great Falls Pwr. Co., Great Falls, it is reported, is contemplating extending its transmission lines to Box Elder.

HAMBLIN, MONT.—The People's Tel. Co., recently incorporated with a capital stock of $25,000, will soon begin work on the erection of telephone lines to serve Hamblin, Circle, Wolf Point and Paxton.

TERRY, MONT.—The Town Council has granted L. H. Gaffney, Terry, a franchise to construct and operate an electric-light plant here.

FREDERICK, COL.—The installation of a special street-lighting system is under consideration by the City Council.

Canada

GREENWOOD, B. C.—The British Columbia Copper Co., Greenwood, is reported to be contemplating the construction of a concentrating plant at its Copper Mountain properties, to cost about $500,000. This is to be operated by an electric-power plant to be erected, it is understood, either at Princeton or Coalmont, the cost of which is estimated at about $300,000. Oscar Lachmund is general manager of the company.

PORT STANLEY, ONT.—Plans are being prepared by the Port Stanley Railway Board for the installation of an ornamental street-lighting system.

TORONTO, ONT.—Tenders will be received by the chairman of the Toronto Electric Commissioners, Toronto, until Nov. 16 for lead-covered cable. Specifications may be obtained at the office of the purchasing agent, 15 Wilton Avenue, Toronto.

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EASTERN NEW YORK SECTION, N. E. L. A. Secretary, Lee Hagood, General Electric Co., Schenectady, N. Y.

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ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

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ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next quarterly meeting, Hot Springs, Va., Nov. 17-19.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago. Next meeting, Nov. 8-10. Homestead Hotel, Hot Springs, Va.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Executive secretary, A. Jackson Marshall, 29 West 39th St., New York. Sections in the principal electrical centers throughout the country.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

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INDEPENDENT TELEPHONE ASSOCIATION OF AMERICA. Secretary, W. S. Vivian, 19 South LaSalle St., Chicago.

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INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 71 Broadway, New York.

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary, W. H. Thompson, Des Moines, Iowa.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Iowa.

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MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

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NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Annual meeting, New York, July, 1916.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Permanent headquarters, Room 204, Hotel LaSalle, Chicago, Ill. Annual convention, Chicago, Dec. 8-10.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

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NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M. Meeting, Albuquerque, Feb. 14-16. 1916.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

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SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

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SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. 1916 convention,, May 17-20, Galveston, Tex.

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WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

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[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,157,663. Automatic Circuit-Control Apparatus; M. Barron, Rogers, Tex. App. filed Nov. 29, 1913. For electric-lighting systems.

1,157,687. Branding Iron; J. G. Garner and W. Gutman, Detroit, Mich. App. filed May 20, 1915. Electrically heated half-disk branding die.

1,157,691. Electric Furnace; S. Guggenheim, Berlin-Wilmersdorf, Germany. App. filed Feb. 18, 1914. Material operated upon becomes the seat of eddy currents.

1,157,694. Process of Insulating Wire; O. T. Hungerford, Belleville, N. J. App. filed Aug. 17, 1907. Covered wire subjected to pressure in impregnating tank and drawn from tank through die.

1,157,696. Ignition System; L. D. Kellogg, Chicago, Ill. App. filed Oct. 28, 1912. Uni-spark principle.

1,157,702. Catenary Suspension of the Trolley Wire for Electric Railways; F. Lauterbacher, Munich, Germany. App. filed Oct. 17, 1914. Sliding suspension means between the messenger and trolley wires.

1,157,730. Static Frequency Changer; F. Spinelli, Milan, Italy. App. filed March 20, 1913. Three-phase into monophase.

1,157,731. Electric-Cooking Apparatus; R. Sprenger, Hennigsdorf-Berlin, Germany. App. filed April 4, 1914. Hotplate is pressed against the cooking vessel.

1,157,740. Controlling Mechanism for Printing Presses; J. J. Walser and C. A. Dresser, Chicago, Ill. App. filed Aug. 22, 1912. Starting, stopping and speed changes controlled electrically.

1,157,745. Automatic Telephone System; R. S. Wilbur, Jersey City, N. J. App. filed July 11, 1910. Apparatus employed in connection with each selector switch automatically cut off as the connection proceeds.

1,157,746. Telephone System; C. S. Winston, Chicago, Ill. App. filed Jan. 2, 1913. Automatic ringing and automatic busy signal.

1,157,777. Control System; A. J. Hall, Wilkinsburg, Pa. App. filed Jan. 30, 1914. For trolley cars, etc.

1,157,779. Means for Suppressing the Resistance of the Negative-Electrode Flame in Vapor-Electric Apparatus; P. C. Hewitt, Ringwood, N. J. App. filed March 21, 1902. Solid horizontal anode and mercury cathode.

1,157,782. Winding Switch for Self-Winding Clocks; E. A. Hummel, St. Paul, Minn. App. filed June 30, 1914. Non-vibrating, snap-acting switch.

1,157,804. Starting Device for Mercury-Vapor Apparatus; J. C. Pole, New York, N. Y. App. filed Nov. 14, 1912. Includes a solenoid in circuit.

1,157,819. Electric Furnace; E. Stassano, Turin, Italy. App. filed Aug. 24, 1914. Cooled electrode guide.

1,157,820. System of Control; N. W. Storer, Pittsburgh, Pa. App. filed Dec. 4, 1913. Single unit reverser and field change-over switch.

1,157,821. System of Control; N. W. Storer and A. J. Hall, Pittsburgh, Pa. App. filed March 18, 1914. Electro-pneumatic.

1,157,823. System of Car Operation by Vapor Converters; P. H. Thomas, Montclair, N. J. App. filed Aug. 2, 1905. Converters in parallel with direct-current motors.

1,157,824. System of Car Operation by Vapor Converters; P. H. Thomas, Upper Montclair, N. J. App. filed Aug. 2, 1905. Single-phase rectifiers fed from separate phases.

1,157,830. Electrolytic Refining of Tin; R. L. Whitehead, Perth Amboy, N. J. App. filed May 4, 1915. Prevents contamination of the tin deposited from the impure tin.

1,157,839. Telegraphy; D. L. Bobroff, Milwaukee, Wis. App. filed July 6, 1914. Directory for indicating "out" or "in."

1,157,845. Signal System; C. W. Coleman (deceased), Westfield, N. J. App. filed March 16, 1908. Double-track block system.

1,157,850. Traffic-Controlling System for Railways; A. V. T. Day, New Rochelle, N. Y. App. filed Oct. 29, 1908. Reduces necessity for sensitive instruments

1,157,859. Ozone Generators; W. O. Freet, Hackensack, N. J. App. filed Sept. 9, 1912. Electrodes cooled by ammonia or the like.

1,157,863. Combined Burglar Alarm and Lock; A. Hamelin, Montreal, Quebec, Canada. App. filed June 29, 1914. Electric-bell arrangement.

1,157,904. Controller for Electric Motors; L. G. Riley Wilkinsburg, Pa. App. filed Nov. 8, 1911. Series-multiple.

1,157,912 Commutator; H. W. Turner, Glenville, N. Y. App. filed March 2, 1915. Enameled metal sheets for insulation.

1,157,916. Insulated Wire and Terminal Therefor; A. M. Wentworth, Pittsfield, Mass. App. filed Aug. 24, 1914. Sheathed wire with enlarged terminal.

1,157,919. Electric Cut-Out; W. C. Arsem, Schenectady, N. Y. App. filed Feb. 26, 1914. Fuse surrounded by loose particles of silicic acid

1,157,923. Electric Permutation-Switch Mechanism; O. D. Bowers, Arcanum, Ohio. App. filed May 20, 1915. For automobile switches.

1,157,925. Vacuum-Tube Electrode and Process of Operating Same; W. D. Coolidgem, Schenectady, N. Y. App. filed Sept. 7, 1912. Tungsten disk with copper holder.

1,157,926. Electric Meter; A. G. Davis, Schenectady, N. Y. App. filed Jan. 13, 1913. Friction-compensating device.

1,157,930. Mechanism for the Control of Circuit-Breakers; L. L. Elden Dorchester, Mass. App. filed June 20, 1901. Automatic tripping mechanism.

1,157,937. Electric Meter; M. Helm, Pankow, Germany. App. filed May 24, 1912. Multiple-rate.

1,157,948. Alternating-Current Commutator Machinery; H. Meyer-Delius, Baden, Switzerland. App. filed June 13, 1910. Compensates for transformer emf.

1,157,949. Electric-Alarm Mail Box; B. D. Miller, Wooster, Ohio. App. filed Sept. 9, 1914. Lid closes signal contact.

1,157,955 Electric Regulator; G. S. Neeley, St. Louis, Mo. App. filed Sept. 9, 1910. For car lighting.

1,157,963. Control Mechanism; E. T. Shaw, Pittsfield, Mass. App. filed Dec. 12, 1914. For starting, stopping and controlling speed.

1,157,970. Dynamo-Electric Machine; J. B. Wiard, Lynn, Mass. App. filed May 15, 1914. Centrifugal switch.

1,157,971. Car Truck; W. S. Adams, Philadelphia, Pa. App. filed Nov. 17, 1914. Special bolster support.

1,157,990. Electric Signal; C. H. Light, Des Moines, Iowa. App. filed March 17, 1913. Signal circuit extended through fire hose.

1,157,995. Incandescent Lamp; G. M. J. Mackay, Schenectady, N. Y. App. filed Sept. 11, 1914. Filament arranged in concrete coils.

1,158,001. Automatic Voltage Regulator; G. S. Neeley, St. Louis, Mo. App. filed July 1, 1912. Carbon pile kept in state of agitation.

1,158,037. System of Electrical Distribution; E. Evans, Berlin, Germany. App. filed Nov. 12, 1912. Current-limiting device.

1,158,052. Rheostat; A. J. Horton, White Plains, N. Y. App. filed Feb. 20, 1915. For "pathescopes."

1,158,060. Electric Switch; C. J. Klein, Milwaukee, Wis. App. filed Feb. 13, 1914. Push-button snap operation.

1,158,081. Electric Pocket Lamp; J. Stock, Dunton, N. Y. App. filed April 2, 1915. Switch for fountain-pen type.

1,158,083. Direction Indicator; H. E. Stout, Toledo, Ohio. App. filed Feb. 25, 1914. Selective switch for motor-vehicle signal system

1,158,086. Circuit Interrupter; J. A. Vahey, Boston, Mass. App. filed Jan. 15, 1912. Fault-finder for alternating-current distributing system

1,158,091. Electrical Transformer Controller and Distributer; F. L. Wiltshire, Martinsville, Ind. App. filed Dec. 12, 1914. Ignition system with synchronous high-frequency alternating-current magnet.

1,158,103. Party-Line Ringing System; C. C. Bradbury, Chicago, Ill. App. filed July 6, 1908. Series contacts disconnected during conversation.

1,158,105. Insulating Tube; E. F. Callender, Galesburg, Ill. App. filed Feb. 9, 1914. Frangible body with tapered fins.

1,158,112. Detector for Oscillating Currents; W. E. Beakes, Brant Rock, Mass. App. filed May 9, 1911. Antimony and ferro-silicon electrodes.

1,158,123. Apparatus for Generating and Receiving Electromagnetic Waves; R. A. Fessenden, Washington, D. C. App. filed Aug. 26, 1904. Simultaneous variation of the periods of the radiating and oscillating circuits.

1,158,124. Signaling Apparatus for Aerial Navigation; R. A. Fessenden, Brant Rock, Mass. App. filed Feb. 11, 1909. Antennas constitute bearing surfaces.

1,158,143. Electric Signaling System; C. P. Nachod, Philadelphia, Pa. App. filed Oct. 13, 1908. Single-track-railroad improvement on patent No. 825,927.

1,158,145. Electrical Fuse Plug; N. W. Nutt, Trenton, N. J. App. filed Jan. 24, 1914. Two-part, with indicator.

1,158,146. Electrical Burglar, Fire and General Alarm; H. W. Olney, Spokane, Wash. App. filed May 21, 1913. Reinstating device.

1,158,149. Insulator Support; C. L. Peirce, Jr., Pittsburgh, Pa. App. filed May 4, 1914. Wire-helix thimble.

1,158,171. Method of Cementing Carbon Articles; J. W. Brown, Lakewood, Ohio. App. filed June 6, 1912. Impregnating material caused to flow under pressure by electric current.

1,158,176. Electric-Cooking Stove; A. O. Christensen, Franklin, N. J. App. filed March 9, 1915. Partitions and series coils.

1,158,200. Pull Socket; J. G. Girling, Hartford, Conn. App. filed May 19, 1915. Porcelain casing and insulating pull cord.

1,158,203. Under-Contact Rail and Support; A. Gollos, Chicago, Ill. App. filed Sept. 30, 1912. Beveled approach.

1,158,221. Party-Line Telephone System; H. Hovland, Lincoln, Neb. App. filed Oct. 31, 1912. Direct connection between parties on the same line.

1,158,233. Automatic Position Indicator for Guns; W. D. Kilroy, Chiswick, England. App. filed May 26, 1910. For superposed turrets, etc.

1,158,243. Transmission Apparatus; A. B. Lakey, South Bethlehem, and E. E. Ross, Philadelphia, Pa. App. filed May 20, 1909. Electric device for gasoline-driven automobile.

1,158,253. Process of Dehydrating Oil; F. W. McNear, Menlo Park, and P. E. Bowles, Jr., Reward, Cal. App. filed June 26, 1915. Electrolysis and gravity separation.

1,158,255. Automatic Stop for Elevators; P. L. Manlet, St. Paul, Minn. App. filed Sept. 27, 1911. Electric brake.

1,158,278. Wrapping Machine; W. B. and F. M. Pierce, Chicago, Ill. App. filed Aug. 7, 1911. For wrapping coils.

1,158,286. Electric-Lighting Fixture; J. D. Raymond, Chicago, Ill. App. filed June 12, 1915. Socket adjusted in fixture.

1,158,309. Transmitter for Wireless Telegraphy; Carl Schou, Holte, Denmark. App. filed Jan. 12, 1914. Relay construction.

1,158,346. Outlet Hood for Conduits; W. M. Webb, Philadelphia, Pa. App. filed March 24, 1911. Prevents entrance of water, etc.

1,158,355. Pedal Switch; W. S. Willis, New York, N. Y. App. filed Oct. 12, 1914. For signal lamps.

1,158,375. Submarine Telegraphy; K. C. Cox, Norfolk Island. App. filed March 23, 1915. Uses selenium relay.

1,158,405. Machine for Wrapping Commercial Coils of Wire; F. M. and W. B. Pierce, Chicago, Ill. App. filed May 21, 1909. Exposed edge of wrapping ribbon is folded under.

1,158,406. Wrapping Machine; F. M. and W. B. Pierce, Chicago, Ill. App. filed Aug. 11, 1910. Shutter has a high capacity of wrapping material.